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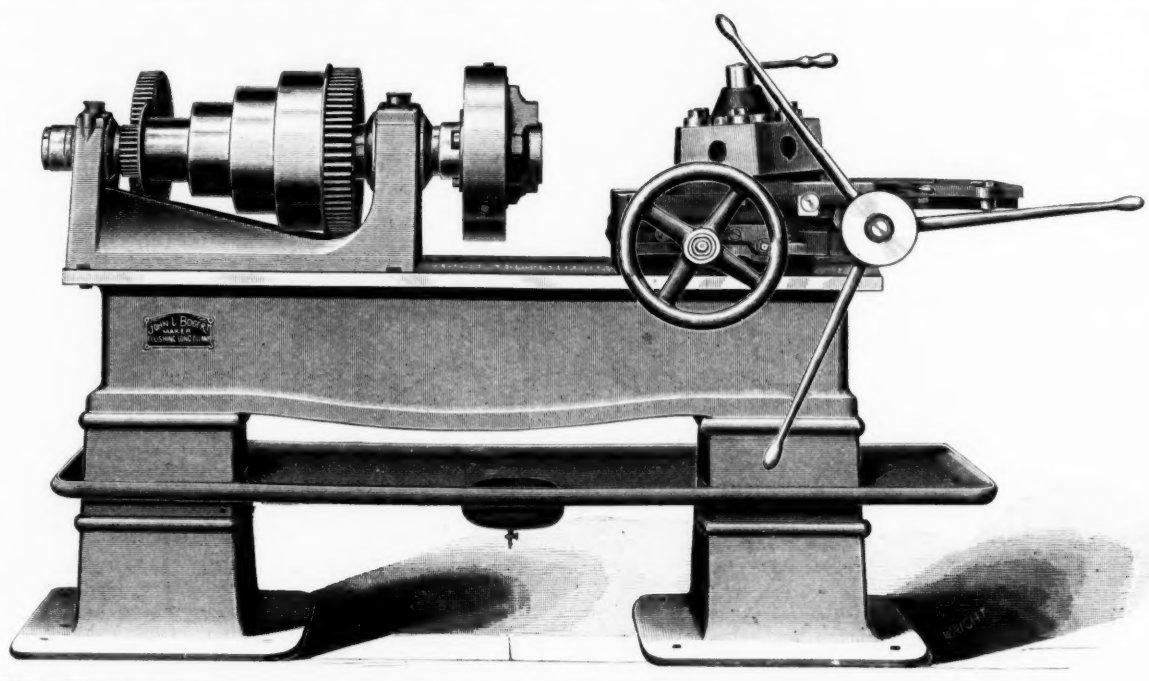
Some New Turret Machines.

We give on this page and on page 2 illustrations of two machines which we consider have a number of points of interest to mechanics and manufacturers.

The first of these is called a set-over turret machine, and it is designed especially for the class of work done on parts of engines, pumps, hydrants, etc., which require several operations to be performed on them, each true with the other, and, therefore, to be done at one chucking if possible.



It is not a screw machine, but is rather a chucking lathe, with what may be called a magazine tool post (the turret) which may be moved in the usual way in line with the spindle, or across the bed for adjustment of tools to cut, or for facing.

The arrangement of this turret and of the slides which support it constitute the distinctive feature of the tool, the object being to enable tools not more costly than ordinary lathe tools, and usually in fact not costing as much, to be used in much the same manner as lathe tools are used, except that the slides and means of support are much more ample than we expect to find in a lathe of corresponding capacity, giving increased efficiency, aside from the fact that one after the other the tools can be brought into position by the revolution of the turret, without waiting to set a new tool for each operation.

In order to get the tools and their support as close to the work as possible, the cut-off slide is dispensed with, all its functions, so far as required on this machine, being performed by the cross-feed motion under the turret.

It will readily be seen that the machine thus arranged has some peculiar advantages, in fact, many of the advantages for heavier work that are possessed by the well-known Fox lathes for brass work.

Being intended for the heaviest work within its capacity this machine is driven by a 3½″ double belt, and has back gears in the ratio of 12 to 1, these being found none too powerful when driving—say a 5″ tap.

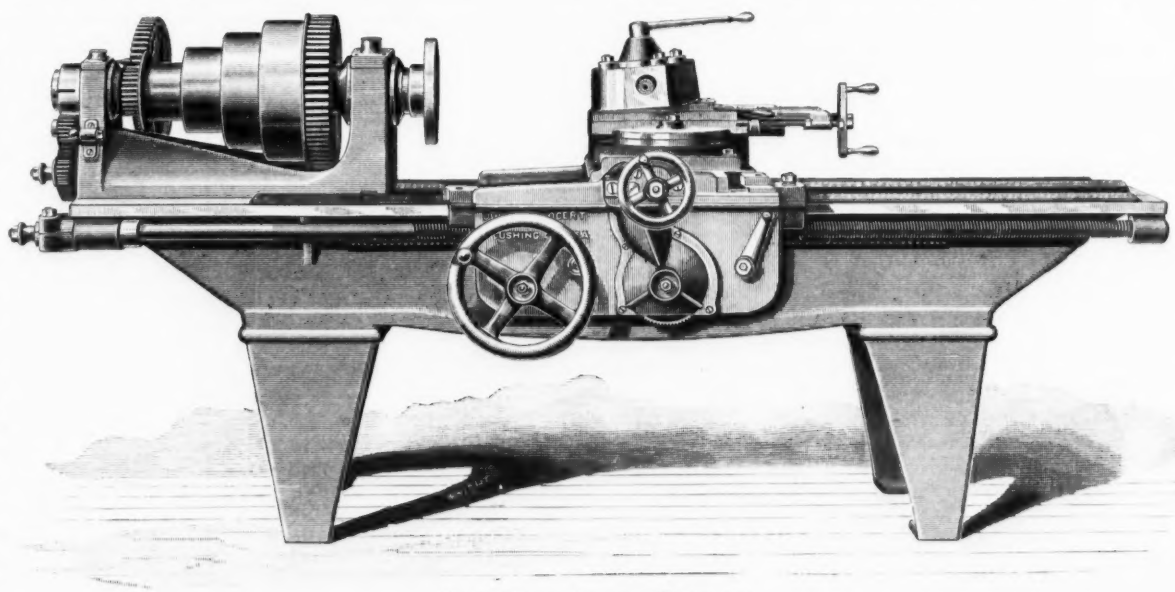
The spindle can have a 2-inch hole bored through its center, but it is not usually made larger than 1 1/16″. Those whose work makes it desirable can have an improved friction back gearing, usually arranged in combination with a three step cone for a 4½″ belt, but the ratio of this frictional gearing has to be 9½ to 1 to drive the cuts and taps used in the machine, as illustrated.

The cross-slide base, which is anchored securely in any desired position along the bed by two 1¼″ bolts, has its upper surface 16″ wide, with a dovetailed gib one inch thick. The cross-feed screw is 1¼″ in diameter, cut three threads per inch, square, and its nut of bronze is 3¼″ long. The cross-slide itself is 28″ long, and carries beside the turret and its slide the rack shaft with its pilot wheel, also the front and back stop screws that limit the set-over. The turret slide has suitable stops for governing the length of cuts or depths of holes bored. The indexing of the turret is by a large, flat ring of hardened steel, and the lock bolt is adjustable for wear by means of a hardened steel taper wedge, which is kept in adjustment by two screws.

The turret is 14″ in diameter, and usually bored for six 2½″ holes. The size and number of holes, however, may be varied to suit the work. A keyway at the bottom of each hole, a clamp shoe bored out at the same time with the hole, and four ⅝″ tapped holes in each of the faces of the turret insure that the tool shall not slip while under cutting strain. The axis round which the turret revolves is inclined forward toward the head-stock, so that the tools not in operation are lifted well clear of the top of the turret slide. The general design of the bed, legs, pan and strainer are too obvious to require extended comment or description.

The machine swings 20″, has a bed 5 feet 6″ long, and weighs 3,000 pounds.

The second machine, while it has many of the features of the other, more nearly approaches the engine lathe in appearance, this resulting from the fact that the turret is given automatic feeds in either direction, and between the cross-slide and the turret is a compound rest, enabling cuts to be taken at any angle, and without in any way interfering with the use of the two other motions. There is a lead screw, also by the use of which threads may be cut by ordinary threading tools, and taps or dies forced to their work at the proper rate.



SOME NEW TURRET MACHINES.

Like the other machine, this one has a four step cone for a 3½″ double belt. The spindle is of hard steel, with boxes lined with phosphorized babbitt metal. It may have a 2″ hole through the spindle. The ratio of back gearing is 12 to 1.

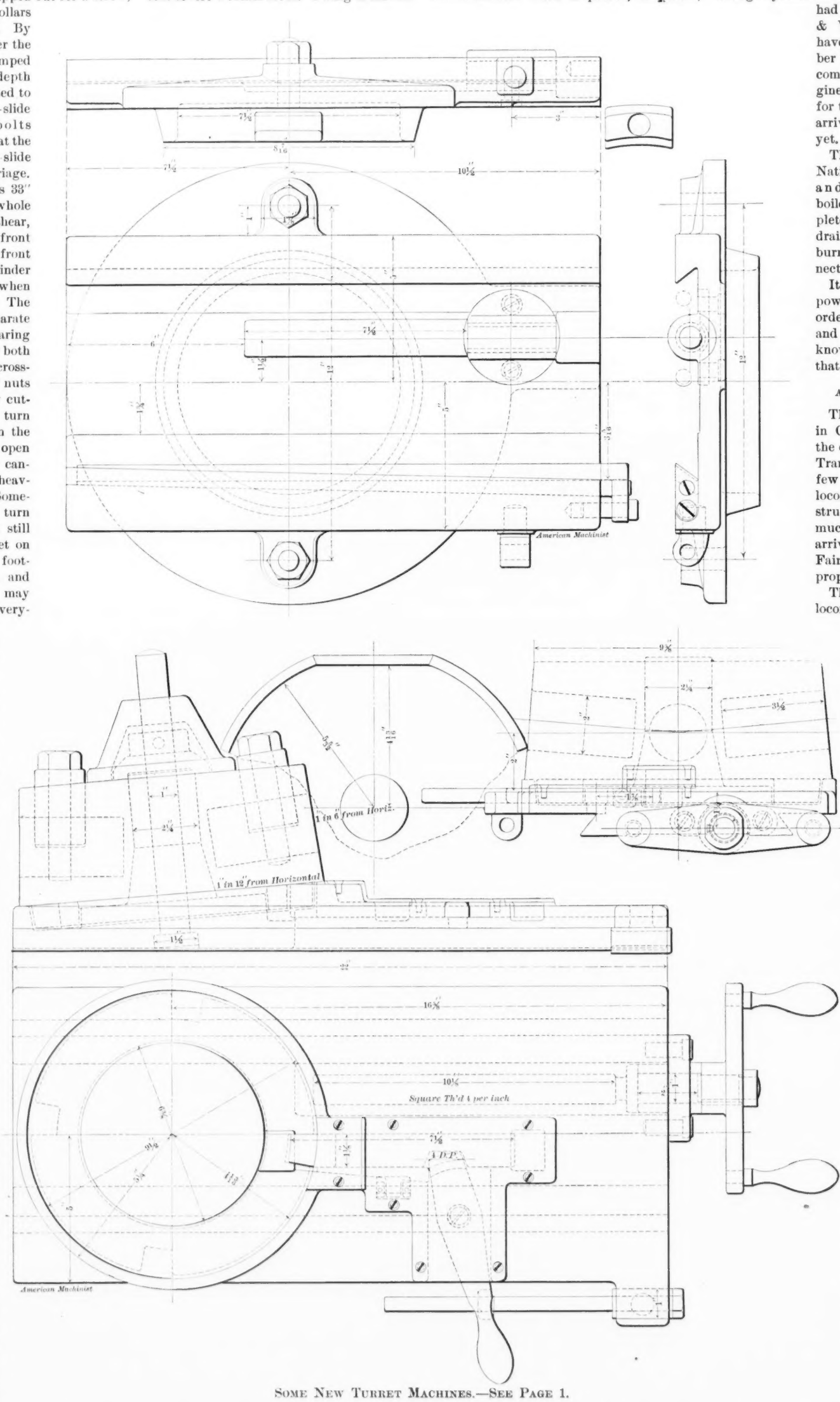
We cannot, perhaps, better convey an idea of the stiffness of the head-stock than by mentioning the fact that a piece of cast-iron pipe 13″ in diameter, 23″ long, ⅞″ thick, held by four ⅝″ bolts through a flange and the large face-plate, has been turned at its outer end with a cut 5/16″ deep and 1/16″ feed without chatter. Though usually constructed as shown in the cut, it may be changed if the nature of the work renders it desirable for one having improved friction back gearing. As the ratio of the back gearing in a friction geared head, while it might be increased, is seldom made greater than 6 to 1, it would require a belt 7″ wide to take the cuts that are taken with this head. By means of the usual rocker on the end of the headstock the direction of the feeds may be readily changed. To cover all varieties of work, a four-jaw independent, a three-jaw universal, and a two-jaw universal chuck should be provided.

The turret is made in shape a frustum of a cone with its axis of revolution so inclined to the vertical that its front face is vertical. Hence as the turret is revolved the ends of the turret tools are elevated so as to clear the top of the turret slide. The indexing is by a flat hardened steel ring made as large in diameter as possible. The lock bolt of hardened steel is adjusted for wear by a hardened taper wedge locked in adjustment by two screws. The turret and the turret slide have a hand-feed movement of 8 inches on the swivel slide by means of a 1-inch screw, cut four threads to the inch, square. A stop screw on the side of turret slide limits this movement as desired. The swivel slide can be revolved completely around into any horizontal position upon the circular top of the cross-slide, which is 16″ in diameter, and graduated in degrees. Two ¾″ bolts clamp it secure against the strain of heavy side cuts. The peculiar construction of the cross-slide permits a cross-feed for the full swing of the lathe. By means of a telescopic slide the cross-feed screw and gearing are at all times protected from chips, while the telescopic slide may at pleasure be pushed back to permit an examination or oiling of these parts. The value of some such device is most apparent when operating on cast-iron, the roughing chips of which always contain more or less sand. There is a stop rod

for screw-cutting after the manner of the best lathe practice.

A binder and screw through the top of the cross-slide clamp this rod at any point in the travel of the cross-slide. The stop rod has its front end tapped out for a screw, which is made with collars to permit ¾" end play. By turning the screw after the stop rod has been clamped to the cross-slide, the depth of cut may be regulated to a nicety. The cross-slide anchor and anchor bolts eliminate all vibration at the joint between the cross-slide and the top of the carriage. The carriage, which is 33" long, is gibbed its whole length on the back shear, and at each end on the front shear. One of these front gibs is utilized as a binder clamp for the carriage when tools are cross-feeding. The apron contains separate powerful frictional gearing of phosphor bronze for both the longitudinal and cross-feed, as well as the half nuts used only when screw cutting. One-third of a turn of the handle shown on the apron will close or open these latter, and they cannot fly open under the heaviest strain of feeding. Sometimes it is desired to turn work on centers, and still make use of the turret on compound rest. A footstock is then fitted, and work 7½" in diameter may be revolved clear of everything. Any desired pitch of screw thread within the range of the change gears furnished may be cut with the aid of the lead screw. The bed will be readily recognized as of Mr. Bogert's well-known design. He informs us that in 1882 he made the first drawing for a machine tool bed deeper in the middle than at the end, and in 1885 developed this detail to its present symmetrical outline. The diagonal cross-bracing of the shears converts the plan into a series of triangular cells. Those who have used Mr. Bogert's style of bed in machine tools can best testify as to their rigidity under the severest conditions of strain.

This machine swings 20", has a bed 8 feet long, and weighs 3,600 pounds. The machines are built by John L. Bogert, Flushing, Queens Co., N. Y.



SOME NEW TURRET MACHINES.—SEE PAGE 1.

There is considerable agitation in Paris looking to a yearly appropriation by the Government of France to be applied to completing the Panama Canal. It seems hardly probable that this great work will be permitted to go unfinished. The more the conduct of the company that started the construction of this canal is investigated the worse it looks for those concerned.

Columbian Exposition Notes.

PROGRESS IN THE POWER PLANT.

Work in the power plant is resuming that busy appearance which it had before the recent severe weather set in. Owing to that extreme weather, and to the slow rate at which manufacturers have been sending their machinery, the progress has been rather slow. But now all hands are hard at work, and there is more than enough to keep them busy.

A large number of dynamos, including some of the heavy castings for the six-belt driven 1,000 H. P. Westinghouse dynamos, and a number of engines and condensers are on the floor, and will be on their foundations before another week is passed, and these, with the machines already in place, will make a very good showing.

The following engines are ready for their steam and belt connections: McEwen, two Russell, Watertown, three Buckeye, two 400 H. P. Westinghouse, three Ball & Wood and one Woodbury, as well as all the circulating pumps (Worthington), and three of the four Norwalk air compressors. One of these compressors has been furnishing air for the sewage system for several months; steam is had from a pair of Babcock & Wilcox boilers, which have been in use since October last. The above are all comparatively small engines. None of the castings for the larger engines have arrived at the building as yet.

The Gill, Root, Heine, National, Cambell & Zell, and Babcock & Wilcox boilers are practically completed. The feed water, drain, and oil pipes and burners are now being connected up.

It is necessary that the power plant be in running order by the 15th of April, and those in position to know express a firm belief that it will be.

AN OLD LOCOMOTIVE.

The first locomotive ever in Chicago was placed on the exhibition tracks in the Transportation Building a few days ago. That this locomotive which helped the struggling young city so much should be the first to arrive at its great World's Fair of to-day seems very proper.

The "Pioneer," as this locomotive is called, was built by M. W. Baldwin, at Philadelphia, in June, 1836, for the Utica & Schenectady Railroad. In 1848 it was bought from them by the Galena & Chicago Union Railroad, and was the first locomotive owned by that company. The "Pioneer" was brought to Chicago by vessel. It was in active service for thirty-five years, and for three years afterward was often brought into temporary service.

Her dimensions are interesting when compared with those used to-day. The cylinders are 11 inches diameter; stroke is 18 inches. There is one pair of drivers, 54 inches diameter, and a four-wheeled truck forward. The cylinders are high above this truck, snug to the boiler, and the cranks are just inside the drivers. The valve gears are of the hook motion type, hung just outside the bearings. The boiler is 37 inches diameter. The fire-box is of iron 32x37 inches, built for burning wood. The engine is standard gauge, and weighs only 24,000 pounds.

The first track of the Galena & Chicago Union Railroad was built with cross-ties, such as are used to-day, with a 6x6-inch stringer on top. On this stringer was an oak ribbon 1x3 inches wide, and above this a strip of iron ⅜ inch thick.

The above railroad now forms a part of the Chicago & Northwestern railway system.

GENERAL NOTES.

Exhibits for all departments are arriving fast, and installation work is well under way. Locomotive cranes have been found almost indispensable for unloading the heavier exhibits, and six of them are kept busy in the buildings and on the grounds. These cranes are from the Industrial Iron Works, of Bay City, Mich. Two of them are of 12 tons, and the remaining four of 7 tons capacity.

Among the first exhibits to be placed in the Mines Building was a steel plate 150 feet long by 20 inches wide and $\frac{7}{16}$ inch thick. Its manufacturers, the Pottstown Iron Works, of Pottstown, Pa., claim that it is the largest plate ever rolled.

In the description of the line shafting in Machinery Hall and Annex in a recent letter, it was stated that a Hamilton-Corliss engine would drive two of the shafts in the Annex. That was the original plan, but it has been decided since to use a 500 H. P. Sioux City engine in its place.

Back Geared Post Drill.

We present with this an engraving of a drill press, the main features of which are, that, while designed and built as well as a machine intended for regular machine shop use, it is adapted to be fastened to a wall or post, and used by carriage builders and blacksmiths. Like the other drill presses made by the same builder it has a sliding head instead of the usual quill, giving a great range of feed and adjustment, with the support of the spindle always close to the work. The sliding head moves 18 inches, and can be moved rapidly by means of the lever at the left.

From the face of column to center of the spindle is 10 inches, and from the post where drill is fastened to center of spindle is 23 inches. As will be seen this machine will drill to the center of a circle 46 inches in diameter. It can be placed at any required distance from the floor, and is thus adapted to a very wide range of work.

Diameter of spindle is 1½ inches; hole is Morse taper No. 3. Cones are 5, 7, 9 and 11 inches in diameter, and with the back gears the machine will do quite heavy work. Total weight about 450 pounds. The machine is made by J. E. Snyder, Worcester, Mass.

Marine Propulsion—II.

BY I. MCKIM CHASE.

The reaction resulting from the projection of a mass of matter is not effected by the nature of the material moved. It is the weight and the velocity that the weight of material acquires that determines the reaction or thrust in the opposite direction.

Fig. 3 represents a gun which is free to move with no other resistance than that due to its weight. Suppose the projectile to weigh 100 pounds, and it is projected by a constant pressure moving through 39 feet in one second. The projectile being acted on by a constant force for one second, the velocity it will acquire will be the same as that when allowed to fall freely through 39 feet, viz., 50 feet per second. Cases of accelerated velocity are compared to the action of gravity; hence, the pressure necessary to project the projectile at 50 feet per second will equal

$$32.2 : 50 : : 100 : 155.27 \text{ pounds.}$$

We can reason this to be correct in this manner. If 100 pounds acting on itself as gravity produces a velocity of 32.2 feet per second then 155.27 pounds acting on 100 will produce

$$\frac{155.27}{100} = 1.5527 \text{ times as much, or 50 feet per second.}$$

This pressure operates to move the gun in one direction as well as the projectile in the opposite. The effect is the same as in the case of the vessel, Fig. 2, where the weight of water discharged equals the weight of the projectile in the present case.

If the gun is prevented from recoiling by being opposed by a resistance at least equal to that of the reacting force, as represented by the lever and weight, Fig. 3, then the reacting pressure becomes simply potential energy, and the kinetic energy of the projectile when it leaves the muzzle will equal the energy developed.

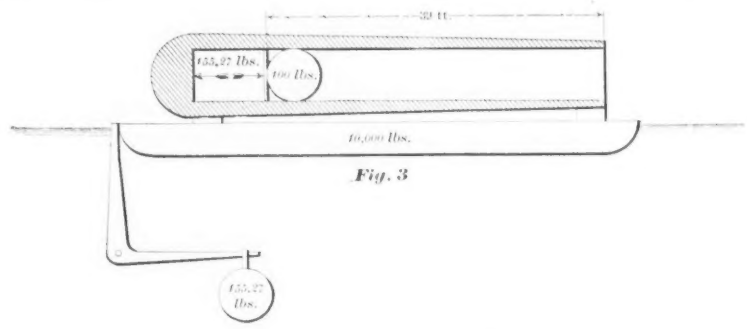


Fig. 3

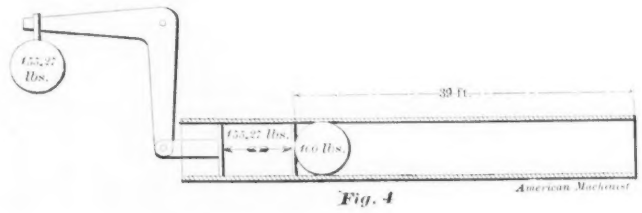


Fig. 4

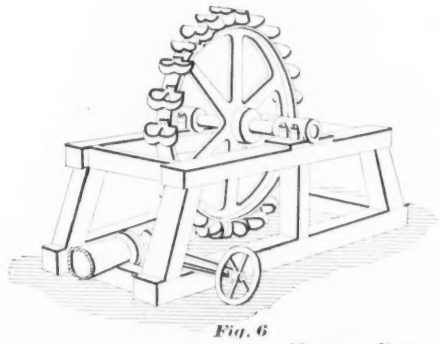


Fig. 6

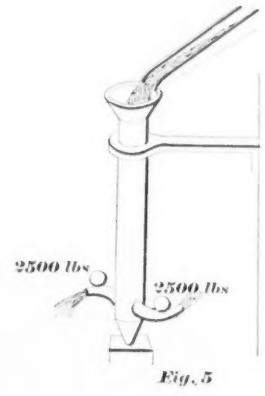


Fig. 5

MARINE PROPULSION.

Eliminating the change of form, the evolution of heat, etc., there is no energy absorbed by the gun unless it is given movement.

The energy developed will equal

$$\frac{100 \times 50^2}{64.4} = 3{,}882 \text{ foot-pounds.}$$

Suppose the gun and float to weigh 10,000 pounds, and are free to move in the opposite direction to that of the projectile, with no other resistance than that absorbed by their weight, then part of the energy developed will be expended in producing this movement, which will equal

$$\frac{155.27 \times 32.2}{10{,}000} = .5 \text{ foot per second,}$$

and the energy necessarily transmuted into the work of producing this effect will equal

$$\frac{10{,}000 \times .5^2}{64.4} = 38.82 \text{ foot-pounds.}$$

Deducting this from the amount developed will leave

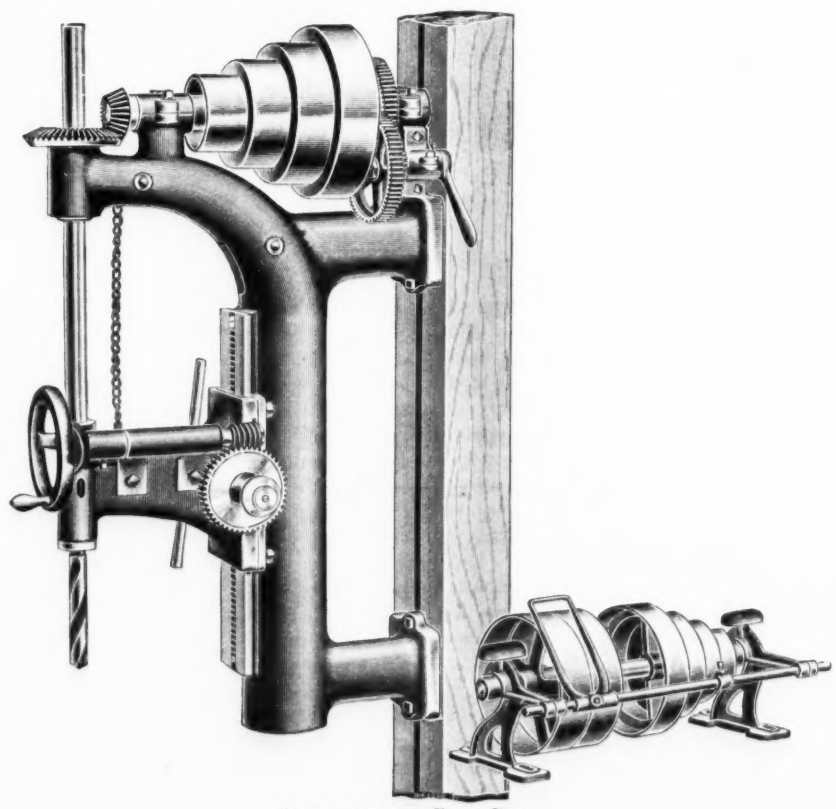
$$3{,}882 - 38.82 = 3{,}843.18$$

foot-pounds impressed into the projectile.

Fig. 4 represents a tube fitted with a movable breech piece or piston, which is loaded to balance the pressure of reaction on the other side.

It is evident in this case that all of the energy developed by the constant force of 155.27 pounds moving through 39 feet in a second is impressed into the shot.

The solution of the foregoing examples demonstrates what has been previously stated in regard to different useful effects desired. When the reactionary effect is to be utilized, as in the case of marine propulsion, by a jet of water, it is advantageous to have the mass projected as heavy, and to move at as low a velocity as possible, and produce the necessary reacting pressure.



BACK GEARED POST DRILL.

When these conditions prevail, the least amount of energy will be wasted, and the greatest proportion will be available for the object sought, viz., the propulsion of the vessel.

When the reverse object is desired, as the penetrating power of a projectile, or the destructive effect of the impact of a column of water, it is advantageous to have the reverse of the foregoing conditions prevail, and have the highest velocity possible impressed into the projected mass.

Higher velocities imply greater amounts of energy. Those engaged in hydraulic mining understand the difference in the destructive effect produced by the impact of a small weight of water moving with a great velocity, and a greater weight moving with a small velocity, and therefore sources of high elevation rather than greater quantities of water at low elevation are sought. Often those sources are situated in the mountains many miles from the mines, to which the water is conveyed by flumes, in the construction of which are exhibited some of the most daring and remarkable engineering feats.

These great velocities of water have been the means of developing an impact type of water-wheel, as remarkable in simplicity as they are in efficiency.

When the reaction resulting from the projection of a mass of matter is to be utilized, as in the case of the propulsion of a vessel, it makes a vast difference in the economy of energy or efficiency of the propelling instrument, whether the force applied to project the water is one acting constantly or one acting impulsively. A propeller acting impulsively may be described as follows:

A method of propulsion has been tried where the vessel was fitted with a cylinder and piston, which constituted a pump, the axis of which was in line with the keel. The outboard end of the cylinder was open, and terminated at the stern.

The piston being at the inboard end of the cylinder, the latter was allowed to fill with water, which the piston was made to expel by its movement to the outboard end of the cylinder. During the return of the piston to its inboard position, of course no thrust was produced, the movement of the vessel resulting from the thrust of the outboard stroke extended through the period of the inboard stroke.

In such a case, suppose the water to be projected at the rate of 200 pounds, and 100 feet velocity per second. Let the water flow for one-half second, and then cease to flow for one-half second, then there will be discharged 100 pounds of water with a velocity of 100 feet per second, and the reaction resulting therefrom will equal

$$\frac{100 \times 100}{32.2} = 310.55 \text{ pounds.}$$

The mean thrust for the entire second will equal

$$\frac{310.55}{2} = 155.27 \text{ pounds,}$$

the same as in the previous example, where 100 pounds of water flowed the entire second with 50 feet velocity.

As before stated, the energy in a moving mass varies as the square of the velocity. Hence, the energy contained in 100 pounds of water moving with 100 feet velocity per second will equal

$$\frac{100 \times 100^2}{64.4} = 15{,}528 \text{ foot-pounds,}$$

or four times the amount that produced the same effect in the previous example, where the flow was constant the entire second.

In boat races, if it could be arranged to have one-half of the crew applying their oars to the water to propel the boat while the other half were on the return stroke, the energy of the rowers would be more efficiently applied.

There is a class of water-wheels that operate purely from the reactionary effect of discharged water, and another class that operate purely from the impact of discharged water. The former have a typical representative in the well-known Barker mill, Fig. 5, and the latter a similar representative in the Pelton wheel, Fig. 6. They

each possess their special adaptive merits. The former where large volumes of water flow with low velocities, and the latter where small volumes flow with high velocities.

The following examples will illustrate their peculiar operative features, and the application of the principles and energy and momentum to them:

Suppose the vertical pipe, Fig. 5, to have a height above the discharge orifices of 25 feet, and is constantly supplied with water to that height while it flows from the orifices. The theoretical velocity with which the water will be discharged will equal

$$8 \sqrt{25} = 40 \text{ feet per second.}$$

Let the aggregate area of the discharge orifices equal two square feet, then there will be discharged

$$62.5 \times 40 \times 2 = 5{,}000 \text{ pounds}$$

of water per second.

The reactionary pressure resulting from this discharge of water tending to revolve the mill in opposite direction will equal

$$\frac{5{,}000 \times 40}{32.2} = 6{,}211 \text{ pounds.}$$

Suppose the mill to be loaded with resistance equivalent to a weight of 5,000 pounds, situated at the same radius as the issuing jets, as shown in the cut. Eliminating all retarding influences, the theoretical velocity with which the mill will revolve in consequence of the discharge of the water will equal

$$\frac{6{,}211 \times 32\,2}{5{,}000} = 40 \text{ feet per second.}$$

This result implies that the water parts with its motion immediately upon its leaving the discharge orifices, and all its energy, which amounts to

$$\frac{5{,}000 \times 40^2}{64.4} = 124{,}223 \text{ foot-pounds,}$$

will be absorbed by the moving weight.

Let a fall of 156.25 feet be substituted for that of 25 feet, then the water will attain a velocity of

$$8 \sqrt{156.25} = 100 \text{ feet per second.}$$

The weight of water necessary to flow at this velocity to equal the energy of the 25-foot fall will equal

$$\frac{124{,}223 \times 64.4}{100^2} = 800 \text{ pounds per second.}$$

The reactionary pressure resulting from this discharge will equal

$$\frac{800 \times 100}{32.2} = 248.44 \text{ pounds.}$$

Assuming the mill to remain in the same condition as with the 25-foot fall, the velocity with which it will revolve will equal

$$\frac{248.44 \times 32.2}{5{,}000} = 1.6 \text{ feet per second,}$$

and the energy developed by the mill at this velocity will equal

$$\frac{5{,}000 \times 1.6^2}{64.4} = 200 \text{ foot-pounds per second.}$$

There is consequently a great waste of the energy of the water.

The mill could be made more efficient with this latter fall by reducing its resistance, and allowing it to revolve faster.

The impact wheel, however, offers superior advantages for those high velocities.

Pipe Computer.

William Cox, Civil Engineer, New Brighton, N. Y., has brought out a new instrument which he calls the "pipe computer," for finding in an easy and simple manner the friction head and the velocity and discharge of water through pipes. This instrument is also useful in those numerous cases in which the length of pipe and the head alone are known, and it is desired to find a suitable diameter of pipe and velocity of flow, to obtain a given horse-power by means of a turbine or water-wheel.

The pipe computer consists of a gradual dial with an inner revolving graduated disk, the whole is mounted on a substantial board 12 inches square, with brass center swivel and locking nut. There are various scales on the computer which correspond to the different terms of the formula whose solution is desired, and their relative positions on the dial and disk are determined by their positions in the formula of which they are the terms. With this instrument a great amount of time and labor is saved, and accurate results obtained. Those who have used it speak well of it.

Where to Obtain Section-lined Paper.

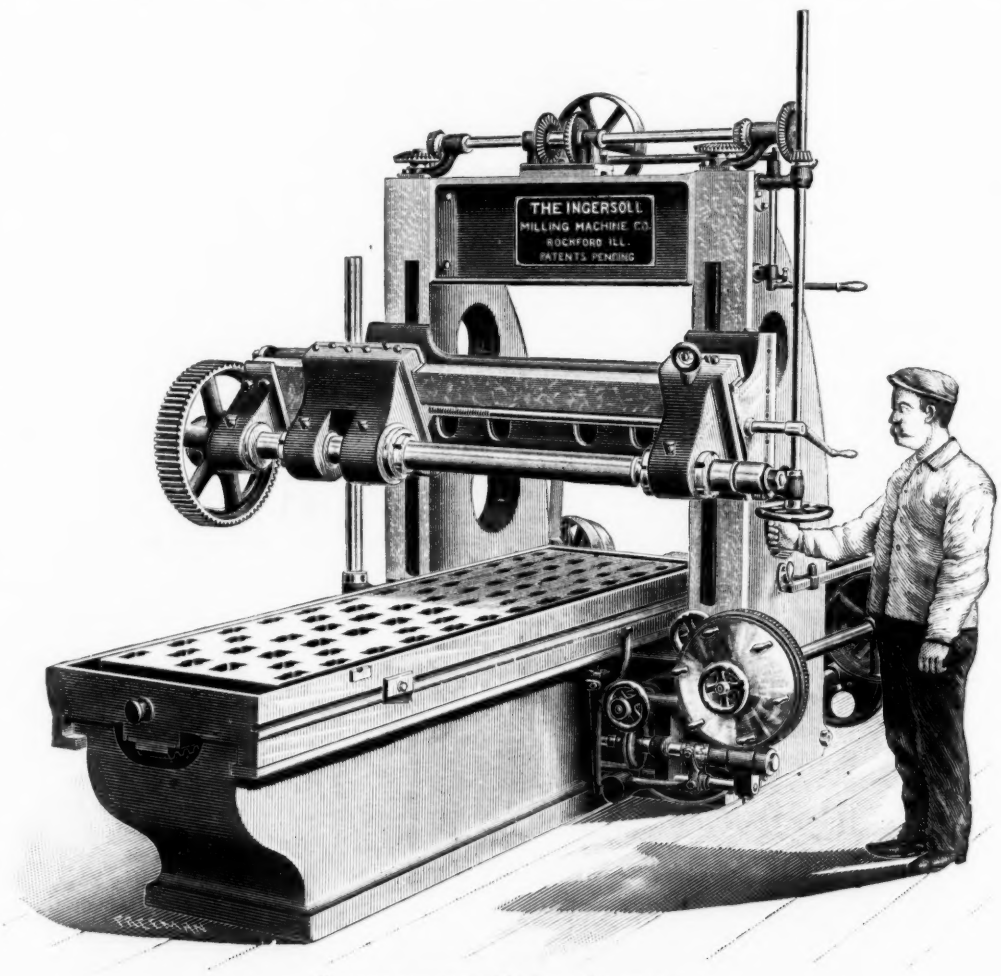
The Brown & Sharpe Manufacturing Co. inform us that arrangements have been made with Messrs. J. C. Hall & Co., of 60 Weybosset street, Providence, R. I., for furnishing section-lined paper, such as they have been in the habit of using. We publish this in answer to the many inquiries we have received relating to the above.

Thirty-six-inch Slab Milling Machine.

The machine which we herewith illustrate, and which is represented as being operated by a man of ordinary stature, is designed for very heavy milling operations on work up to 36″ square and 8 feet long. As will be seen, the machine resembles a planer of heavy proportions, the arbor being supported by two shifting heads which are fitted to the cross-rail, and can be adjusted to support the arbor as close to the cutters as practicable, or in other words, to use as short a cutter arbor as the nature of the work will admit. The cross-rail is moved up and down upon the housings either by hand or power, and its movement is indicated in thousandths of an inch by micrometer graduations. The table can be moved by power either way for adjustment at the rate of 30 feet per minute; it can also be moved by hand. It is spiral geared, and the rate of its movement for feeding can be varied by friction wheel and disk from $\frac{5}{16}$″ per minute with the slowest cutter speed to 5″ per minute at the fastest cutter speed.

The spindle is 5¼″ diameter, with a minimum length of bearing of 25″. It is driven by gears which are in the ratio of 24 to 1, and there are eight changes of speed.

An arbor 3″ diameter and with an outboard bearing 10″ long is furnished with the machine. Cutters up to 15″ diameter and 36″ long can be used on the machine if desired. The driving cone is for a 4″ double belt. Two countershafts are furnished with the machine, each running at a speed of 280 revolutions. The machine will mill at the top of work 36″ high with a 6″ cutter. It weighs about 22,000 pounds, and is built by the Ingersoll Milling Machine Co., Rockford, Ill.



Thirty-six-inch Milling Machine.

Another Fly-wheel Accident and Fatality.

By Peter H. Bullock.

At 9:15 A. M., March 2, a 24-foot fly-wheel of a Cooper-Corliss engine at the power house of the Lowell & Suburban Electric Street Railway was wrecked and the engineer instantly killed. The writer visited the scene about two hours after the accident, and made as close an examination of the wreck as the surroundings would permit, for mechanics were already repairing the broken walls and roof, and falling bricks and timbers made things a little dangerous.

Whatever may have been the primary cause of the accident, no fault of material or workmanship could be seen in the wrecked wheel. About all the breaks were around the end flange of the arms where they were bolted to the rim. The cross-section of the rim at this point looks rather light; yet perhaps it is better for it to break there than to carry away the arms, for if a wheel is wrecked from outside causes the less the disaster the better.

The engine is a cross compound 20x36x24, and run 75 turns per minute. There are two other similar engines already installed, and room provided for two more. Each engine is belted directly to T. & H. generators, and to nothing else, each set making a complete unit of the plant. The pulleys on the generators are about three feet diameter, and the same in width. As there are no binder pulleys used, the arc of contact of the belt on driven pulleys appears rather small for the power transmitted, and the belts must need be pretty tight in order to do the work. Whatever, if any, trouble there may have been with the generator or along the line that would cause any unusual strain on the pulley, I am unable to state, but it is very certain that there was no racing of the engine. It is also evident that the engineer had seen the impending danger, and was doing all in his power to avert the inevitable crash, for the latches were drawn unhooking the rods from the wrist plates, and the throttle was nearly closed.

None of the heavier parts of the engine were injured, only the lighter valve gear being carried away. As far as could be ascertained the driving pulley on the generator failed, and the fragments were carried under the fly-wheel by the belt.

Whether any electrical condition retarded or stopped the generator, I am unable to say, but it is plain to see that should this happen the pulley would very quickly become overheated, and quite likely fractured from unequal expansion. That this series of events did happen no one apparently knows, but circumstances all point in this direction.

This engineer who died at his post of duty set an example of faithful service in the face of imminent danger, and his heroism should not go unsung or his family be allowed to suffer.

Order and Disorder—Keeping Patterns.

By A. L. Bowen.

In my experience as a mechanic I have often been impressed with the entire lack of system that is found in nearly all of the small machine shops, and even in some quite pretentious ones. I wonder why it is that a man whose calling seems to tend towards methodical ways of doing business neglects even the simplest things that would help so much to make things run smoothly. Take a lathe hand, for instance; on the wall back of his lathe there may be a small shelf or only some leather loops nailed up to hold his lathe centers when not in use. Why is it that he lays them on the ways of the lathe, or in the window, or on the floor? Why is it that nine times out of ten he sticks the chuck wrench in the trough under the machine, instead of hanging it where it belongs? Why is it that a man will build a shop that should employ ten or fifteen men, go to an expense of $5,000 or perhaps more, and when it is done the engine room, boiler room and blacksmith shop are all crowded into a place 14x16 feet, with a nine feet ceiling; all the main belts have the pull on the top side, and the fan for the cupola is up between the office ceiling and the roof of the machine shop, where it was necessary to take a lantern to examine the belts and oil up? If the designer of that plant had gone over the plans carefully, and studied out all the details before he laid a brick or drove a nail, he might have arranged matters differently, for he certainly was not pleased with the results. And yet he goes on in the same way and builds his machines in the same unscientific way. There is no method in anything; tools are scattered broadcast; patterns are dumped heedlessly onto shelves in the pattern house, and should a stranger try to pick out the patterns for any machine he would have a hopeless task.

A little thought and a very little expense would help this materially. If the patterns were lettered and numbered he could keep a record of them that would be valuable in more than one way. Then he could have a card with a list of the patterns, giving pattern number and the number of pieces required, thus:

No. 2 horse-power.

A1. Bull wheel, 1 casting.
A2. Pinion, 1 casting.
A3. Spur gear for speeding, 1 casting.
A4. Spur pinion for speeding, 1 casting.
A5. Stud for bull wheel, 1 casting.
A6. Housings for bull wheel, 2 castings.
Two flat boxes No. 12.
Two flat boxes No. 13.

Room should be left on the card for making changes in the patterns. Shelves that are suited to the patterns should be made, and the card hung in a conspicuous place.

Of course it would be quite a job to go all over this entire stock and catalogue and number every pattern, but if on the start an effort had been made to keep a record it would have been inexpensive and very much more satisfactory.

If patterns are marked in this way special core boxes can have the pattern number stamped or painted on, and are then recognized wherever found. Shelves in pattern house should be placarded; and another thing, they should be adapted to their special use. They seem usually to have been put up on the same plan the ordinary tool-chest is—drawers are deeper than necessary for one row of chisels, and not deep enough for two rows. Why build shelves four or five feet wide against the wall to hold a lot of gears, none of which are more than two feet in diameter? If that shelf was ten feet long and two feet wide at one end and six inches wide at the other, it would probably hold all of the gear patterns of one pitch that would be had for years to come, and if six inches above that another shelf of same dimensions was placed it would hold the patterns for next finer pitch, and so on.

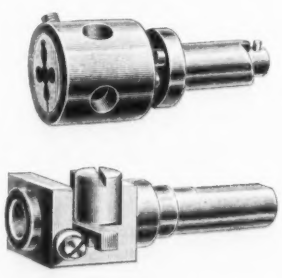
Somebody says, "Why make the shelves narrow at one end and wide at the other; I might want to use them for something else some time, and they will hold the patterns just as well if they are two feet wide at both ends?" That is it exactly. It is that idea that knocks system into a cocked hat. My friend, if you are going to look so far ahead that you may want those shelves for something else, just look a little farther and find another place for that something else that you are dreaming about. The reason that I want them wide at one end and narrow at the other is so the small gears cannot be pushed back against the wall where they may be overlooked. This also allows the shelves to be closer together than if full width the entire length. Cleats about ½ inch square might be nailed on so that each gear should have its own place.

If there are some tram-car wheels, let them be fixed in somewhat the same manner; make the shelves wide enough for the patterns, and no more; put them far enough apart for one wheel, but not far enough for two, then patterns cannot be stacked up only to be knocked over and injured.

Pulley patterns (if you still use them) can be arranged in the same manner, and all should be on the same floor and in the same part of the building if possible, for they are all *wheels*. They are alike in proportions, so that the shelves are similar.

Now with all of these boxes of some kind are used—then why not put them in the same part of the building? For the man who has charge of the patterns can, if there is a methodical arrangement, learn what that arrangement is, and the more readily pick out his patterns and replace them.

This is not an expensive thing to keep up or to introduce. It just simply requires a little effort. If I were to start a shop, no matter how small, I should number every pattern I made and kept, and catalogue it. This catalogue would give the letter and number of the pattern, and a description of it, together with its cost. I might make this record in a five-cent note book, but I would make it and keep it, and if I did business long enough to take account of stock this record would save a deal of labor.



Box Tool and Die Holder.

We present herewith illustrations of some tools for turret machine work, made by E. F. Robbins, of Norwood, Mass.

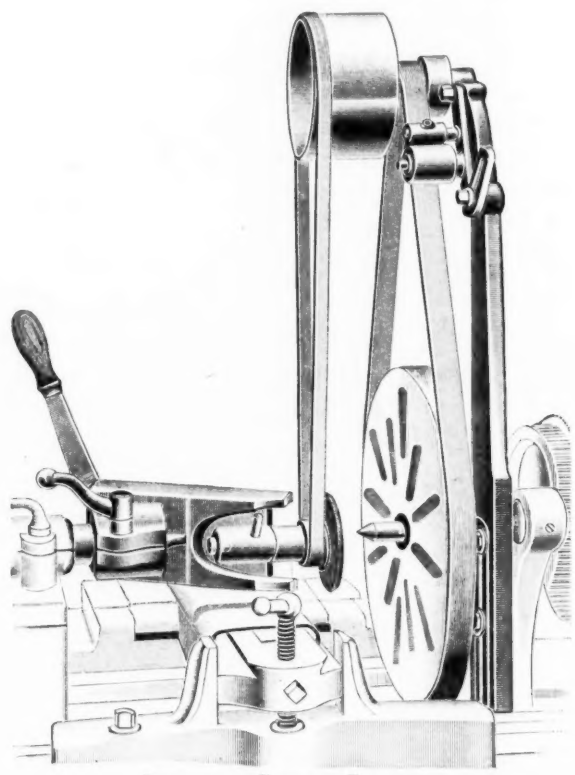
One of these is a box tool made entirely of steel, and with provision for changing the bushing to suit the work. The cutting tool is adjustable to any size within the capacity of the box tool.

The die holder is made for Reece, Carpenter or Elterich dies, and is arranged to automatically release and turn with the work at any desired point, in the usual manner. These tools were developed and proportioned for use in the Almond turret, but are, of course, equally adapted to any small turret machine.

Walker's Improved Center Grinder.

We illustrate herewith a new center grinder which is applied to the foot-stock spindle by clamping over it in the manner shown by the engraving, the device being preferably bored to fit the spindle of the largest lathe in use, and split bushings being used for the smaller ones.

The wheel spindle is mounted upon a slide which is fixed at the proper angle to give correctly shaped centers, the movement of the wheel slide being effected by a conveniently placed vertical lever. The feed is given by advancing the foot-stock spindle. A taper bearing is provided for the wheel spindle, and pains have been taken to provide a smooth working device throughout, which, of course, is important if centers are to be ground as they should be. The wheel is intended to operate at the back of the center, though the entire device may be swung around upon the spindle to get the desired tension upon the belt.



IMPROVED CENTER GRINDER.

The driving device will be readily understood from the engraving. The holes for securing it are readily drilled by a ratchet drill placed against the foot-stock, though we should think that on many lathes the device could be readily clamped in place with C or other forms of clamps.

The large driving pulley runs loose on a stud, and can be driven at two different speeds, thus enabling the approximately correct ratio of speed between wheel and center to be obtained. It will be noticed that the first driving belt cannot affect the smooth running of the grinding spindle.

The Norton Emery Wheel Company, of Worcester, Mass., who make this grinder, give as the result of their experience in grinding centers, the following points:

"The speed of the emery wheel should be about 4,000 surface feet per minute, and the speed of the lathe center [at its largest diameter] about 40 surface feet per minute, *i. e.*, the emery wheel surface should move 100 times as fast as the surface of the work. A variation from this rule is, of course, allowable in practice.

"The tension of the spindle belt should be as slight as possible, an endless belt being preferable.

"It is essential that all loose motion be taken up in the lathe spindle, especially end motion.

"Light cuts should be taken in finishing a center and the feed should be somewhat rapid

"For extremely accurate work, see that the lathe cone and face-plate are running in balance."

LETTERS FROM PRACTICAL MEN.

Tempering Diagram.

Editor American Machinist:

Some time ago I noticed a query in your columns for a tempering diagram, to which you answered you did not know where they were to be had. At the time I would have sent you one if I could have found the ones I had. Having just found them, I herewith hand you one, hoping it will fill its mission. HENRY M. CROUSE.

[The diagram to which our correspondent refers is in the form of a folio printed on heavy card paper by the Dannemora Steel Works, and we presume can be had from the agent of this company, Mr. Edgar Ward, 140 Fulton street, Boston, Mass.—ED.]

Cylindrical vs. Conical Cam Rollers.

Editor American Machinist:

In the many articles which have appeared in your paper of late on the cam roller question, the writers when speaking of conical cam rollers evidently refer to those which are frustums of a cone, the vertex of which coincides with the center lines of cam and roller.

That particular form of conical roller is no doubt inferior to the cylindrical form, but a roller slightly coned and mounted on a stud, so arranged that lost motion may be readily taken up, is superior to either. Both periphery and face cams made in this way have been in successful use for several years in sewing and embroidering machines. They are smooth running and durable, and are easily manufactured, as the rollers may vary somewhat in size, and the cutters, when dull, may be ground and used again.

WILLIAM H. STEDMAN.

Delaying Issue of Patents.

Editor American Machinist:

I am interested in the patent case mentioned by Mr. R. D. O. Smith, as it bears a certain analogy to one of my own.

Some years since I acquired some information in regard to an unexplained natural phenomenon that exists on the other side of the world. Being interested in the matter from a purely scientific standpoint, I cudgeled my brain to find a reasonable explanation. After a while I conceived that if certain conditions existed the phenomenon would naturally result. My first impulse was to publish this explanation; my next was to patent the process and make use of it for my own benefit. Accordingly I made a few experiments to demonstrate the correctness of my theory, and filed my application. The application relates to the utilization of a present waste power for a variety of useful purposes. There is no doubt about it being the first application of its class, as the examiner in charge refused to accept my explanation and statement of results until I had supported that statement by the affidavits of two disinterested witnesses who saw the experiments. This case was filed nearly eight years ago, and has been kept alive, partly by complication in the office and partly by dilatory tactics on my part. My reason for not wishing to issue this patent is simply that I soon found that, to thoroughly protect myself in the use of this entirely new process, I must support the first patent by a long series of other patents bearing upon the devices to be used, and at no time since then have I felt able to shoulder the necessary expense and loss of time.

It will thus be seen that in proposing that the life of no patent extend to a period more than twenty years after the first filing of the case, I am proposing nearly as much of an injustice to myself as I would be to the case mentioned by Mr. Smith. As a matter of fact I do not think that this kind of a circumstance is any injustice at all. It is simply a case where normal conditions work a hardship to an individual like being struck by lightning or getting a bad fall on the ice.

The case mentioned by Mr. Smith is certainly an exceptional one, still the inventor, or his heirs, would have some time left in a twenty-year limit. Furthermore, a case like this could hardly exist if the law made this kind of a limit on the life of a patent. This is obvious from a consideration of what the delays are. An interference that extends "more than four years" has no reason except postponements and dilatory movements on the part of the lawyers. If it is known that time is running against an unissued patent, all parties would be interested in expediting matters, and an interference that could not be decided in a year would be rare indeed.

It is true that time is sometimes needlessly consumed in the Patent Office, but where a large amount is so consumed, it is because at least some of the parties interested are willing to have it so. Three years is ample time for accomplishing much in the Patent Office, and even when exceptional cases consume two or three years more, a very respectable life of patent remains.

It is reasonably certain that if I had control of a valuable process I would seek to prolong that control as much as possible, and that I should not hesitate to use the road left open by the law, as long as others had and used the same privilege. I do not think that the world contains many philanthropists too broad to do the same. I look on the whole thing as wrong, however, as it practically gives to the strong that which circumstances deny to the weak. The ability to extend the life of a patent by delaying the issue indefinitely is calculated to give a wealthy individual or corporation special advantages, as they can safely go on manufacturing, well knowing that they have the power to crush any rival at any time it pleases them. It also has some special advantages to me in my particular case, but I am willing to forego these advantages that even justice may be done to all. C. L. REDFIELD.

Filing Technical Matter.

Editor American Machinist:

The communication of Mr. O. A. Smith, in your issue of February 16, opens again for discussion a subject at once interesting and of marked importance to every progressive man. It has been said that it is not so much what a man knows as what he knows where to find that makes him capable. The one may be a mere encyclopedia; the other, untrammeled by all this burden of knowledge, may at an instant's notice acquire it by turning to the proper source.

It is impossible for the busy engineer of to-day to absorb all of the important information which daily comes to him; and

whether he preserves it at all in any form will depend upon the ease with which he can again turn to if he does preserve it.

There are practically only two means of rendering such information readily accessible. When filed it must either by its subject indicate its location, or a card in a separate card index must specify the exact position that it occupies in the chosen file.

The first method may be adopted in all cases where more than one subject is not treated or concerned in the given matter, and is therefore particularly adaptable when newspaper clippings and simple memoranda are to be filed. But the book or catalogue pertaining to various more or less diverse subjects cannot be so treated unless a separate copy can be filed under each head. The writer's first experience in this line consisted in the purchase of a number of stout pasteboard boxes about 10″x14″x3″ deep, which were properly labeled by subjects, as Boilers, Engines, Pumps, Blowers, etc., and in each of which was placed all the memoranda, catalogues, clippings, etc., which had been gradually accumulating. This was far better than nothing, but it soon came to be a question under which head a catalogue should be filed when its subject matter was almost equally divided, as say between boilers and engines. It couldn't be torn in two, for the subject matter was not so definitely separated in the text. The only resort seemed to be an index of all the subjects contained. But this index to be elastic and serviceable must be in card form, and it seemed a waste of time to index articles and information pertaining to a single subject only, which could readily be found under the subject title, and therefore two systems of filing became necessary—separate, yet independent.

The details of the methods to be followed depend largely upon the character of the material to be filed, and the manner in which it is to be used. Newspaper clippings and material of like size can be most readily and conveniently filed in large and properly titled envelopes. It is, then, in filing any given matter only necessary to slip it into its proper envelope. The envelope system possesses the marked advantage that when any given subject is under consideration the envelope containing all the matter pertaining to the subject may be taken from the files, and there is no searching to collect separated portions.

Material too large for envelope filing may be devoted to the box system, if not complex in its subject matter, or with all remaining material it may be filed in any manner convenient, with some certain designation by number or letter indicating location, and that location specified on the card in the index. Each subject in the given article or book should be indexed on a separate card, filed in its proper place alphabetically. Of course, this separation need not include matter of no possible interest to the owner.

The card index thus formed may be developed into a most serviceable compendium of knowledge, for on similar cards may be indexed the titles of books or articles not owned by the person making the index, but procurable by him. Thus, for instance, a man interested in a particular subject might index such of the matter pertaining to the subject as he could find in the monthly "Index to Technical Literature" in the *Engineering Magazine*, so as to be in a position to purchase at any future time such articles as might then appear to be of value to him.

In the same index could likewise be incorporated cards properly titled and giving data to which frequent reference is made, or memoranda may be entered upon the cards rather than filed in the envelopes.

The man who gets into this matter of filing and indexing will have plenty of new and valuable features presented as he progresses, but he must bear in mind that there is such a thing as going too far in his enthusiasm. There is no use in encumbering such a system with a lot of material of no value from a point of authenticity. Don't file a lot of "guess-so's" and "think-so's" from various men, but record *facts*. Don't endeavor to have a large quantity of material, but let quality and accessibility ever be foremost. Use what you file, and thus prove its value; and if you don't *know* a great deal about a subject, always try to keep yourself in a position to turn, at short notice, to something of value pertaining to it.

Walter B. Snow.

A Geometrical Problem.

Editor American Machinist:

The following problem is usually considered a suitable exercise for the most advanced students in geometry.

Having recently discovered a simple solution by *elementary* geometry, I thought it would be of interest to some of the readers of the American Machinist.

The problem is:

To draw a circle, the circumference of which will bisect the circumferences of any three given circles.

I give in the first place

THE CONSTRUCTION,

which may be drawn by any one who is not familiar with geometrical demonstrations.

Let A, B and C (Fig. I.) be the given circles.

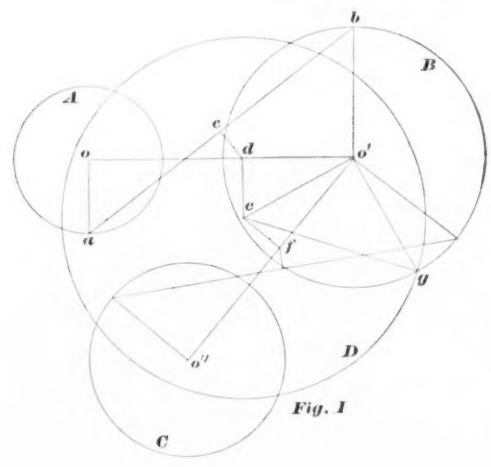


Fig. I

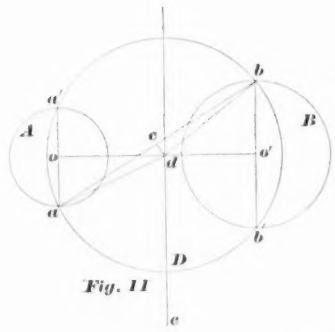


Fig. II

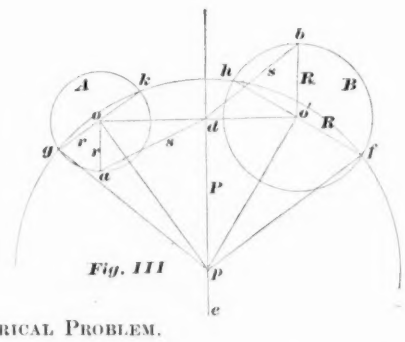


Fig. III

A Geometrical Problem.

1st. Draw $o\,o'$ connecting the centers of A and B, and $o\,a$ and $o'\,b$, radii of A and B, perpendicular to $o\,o'$.

Join a with b and bisect $a\ b$ at c. Draw $c\ d$ perpendicular to $a\ b$, intersecting $o\,o'$ at d.

2d. Draw $o'\,o''$ connecting the centers of B and C, and make a construction precisely similar to that described in the preceding paragraph.

3d. Draw $d\,e$ perpendicular to $o\,o'$, and $f\,e$ perpendicular to $o'\,o''$, intersecting at e, the center of the required circle.

4th. Draw $e\,o'$ connecting e with the center of either of the given circles, and $o'\ g$ a radius of this circle perpendicular to $e\,o'$.

With e as a center and radius $e\,g$ draw the circumference D, which will bisect each of the circumferences A, B and C.

THE DEMONSTRATION.

Fig. II. is a repetition of the construction of Fig. I. Since $c\ d$ is perpendicular to $a\ b$ at the middle point c, d is equi-distant from a and b. Therefore with $d\ a\ (= d\ b)$ as a radius draw a circle D, the circumference of which will pass through the extremities of the diameters $a\ a'$ and $b\ b'$, and bisect the circumferences A and B.

It is required to prove that $d\,e$ (Fig. III.) perpendicular to $o\,o'$ is the locus of the centers of circles which will bisect the circumferences A and B.

On $d\,e$ assume *any* point p.

Draw $p\ o$ and $p\ o'$, and draw the radii r and R perpendicular respectively to these lines.

Draw $p\,f$ and $p\,g$.

We must now prove that $p\,f = p\,g$.

Calling the radii of the circles R and r, $d\ a\ (= d\ b) = s$, and $d\ p = P$.

$$d\,o = \sqrt{s^2 - r^2} \text{ and } d\,o' = \sqrt{s^2 - R^2}$$

$$\therefore p\,o = \sqrt{s^2 - r^2 + P^2} \text{ and } p\,o' = \sqrt{s^2 - R^2 + P^2}$$

$$\therefore p\,g = \sqrt{s^2 - r^2 + P^2 + r^2} \text{ and } p\,f = \sqrt{s^2 - R^2 + P^2 + R^2}$$

$$\therefore p\,g = \sqrt{s^2 + P^2} \text{ and } p\,f = \sqrt{s^2 + P^2}$$

$$\therefore p\,g = p\,f.$$

With p as a center and $p\ f\ (= p\ g)$ as a radius draw a circle which will pass through the extremities of the diameters $f\ h$ and $g\ k$, and bisect the circumferences A and B.

Therefore since p is taken anywhere on the line $d\,e$, $d\,e$ is the locus.

In a similar manner it may be proved that $f\,e$, Fig. I., is the locus of the centers of circles which will bisect the circumferences B and C. Therefore e, the point in which these loci intersect, is the center of the circle which will bisect the three circumferences. The locus of the centers of circles which bisect the circumferences A and C may also be found, and will intersect the other loci at the common point e.

We see then that any two loci may be employed for the determination of the point e.

Frederick R. Honey.

New Haven, Conn.

Cam Motions.

Editor American Machinist:

The reply of Mr. Joshua Rose (in yours of 2d of February) to my insinuation that the article on cams in "Modern Machine Shop Practice" was an appropriation of a communication of Mr. E. Jordan, published in Vol. 4 of *Mechanics* (1883), pages 252, 253, 300 and 301, requires some attention at my hands.

I will premise by saying it has always been my belief that when a writer prepares an article at the request of the party furnishing the information embodied therein, and the article is published under the name of that party, that the writer thereof had no property right of any kind in said article; and that it was as fully and entirely the property of the party who furnished the information contained in it, as it would have been had he actually put the information into words himself. The information conveyed is the soul of the article, for which the mere writer is not responsible, and which he has no more right to appropriate than he would have had it been clothed with the flesh and blood of rhetoric by another hand. If these views correctly express the ethics of this case (and I fully believe they do), Mr. Rose, having (supposing for the moment that he actually did write the article in *Mechanics*, as he says) published the article under the title "Construction of Cams. By E. Jordan," without any mention of himself as the actual writer (there is not even a *suggestion* of a *smell* of Rose about the article), has no right whatever at this late day, after having allowed Mr. Jordan to enjoy his ownership unmolested for nearly ten years, to put in the claim of authorship to protect himself from the charge of plagiarism.

This brings me to the consideration of the question of the actual authorship of the article on "Cams" in *Mechanics*, and its connection with the subject as treated in Mr. Rose's work, "Modern Machine Shop Practice." All of the cuts used in the article of Mr. Jordan in *Mechanics*, eighteen in number, are reproduced in Mr. Rose's work, and by actual measurement 70 per cent. of the text as well; and it so happens that text forms 70 per cent. of the article on cams in "Modern Machine Shop Practice," the remaining 30 per cent. being mainly made up of a description of a method of laying out a "heart cam," for which Mr. Rose now gives Mr. Coleman Sellers the credit. To this portion of the article (which, of course, was not taken from *Mechanics*) there are but three illustrations. So it appears that 70 per cent. of the text, and 85 per cent. of the illustrations, were taken from the article of Mr. Jordan, with the preparation of which I am informed Mr. Rose had nothing whatever to do; for Mr. Jordan has assured me that the article in *Mechanics*, from which Mr. Rose has drawn so liberally, was prepared by Mr. W. E. Partridge (at the time editor of *Mechanics*), and that Mr. Rose had no connection with it. Mr. Partridge tells me that he himself wrote the article in question, from information furnished by Mr. E. Jordan; and that fully believing that Mr. Jordan was entitled to the credit of the article, as all the information therein came from him, his name was placed at its head as its responsible author.

It is only charitable to Mr. Rose to suppose that, in the lapse of time, he may have forgotten the source from which some of the great mass of matter entering into the structure of his book was derived. I have no disposition to do injustice to Mr. Rose when I say that on the above evidence I fail to see that I have (as he says) "jumped to a conclusion that was erroneous." If the matter which I was compelled to call attention to in self-defense is not "plagiarism," I am unable to find in my vocabulary any word that adequately describes it.

W. F. Durfee.

Station Indicator—Cross-section Paper.

Editor American Machinist:

I want to enter my protest against Mr. Phillips' station indicator idea. An indicator located at the end of a passenger coach (as it should be), showing the word Punxsutawney plain enough to be clearly understood by a near-sighted person in the center of the car, would have to extend clear across the car end. Now we will take a P. R. R. coach in general service, and start it out of Jersey City for Philadelphia; from there it goes to Washington over the P. W. & B. division, then over the N. C. to Harrisburgh and to Northumberland or to Oswego and back to Lewistown, and then over the main line to Pittsburgh, and then there is a possibility of its going on over the western divisions to Chicago or Louisville. Now an indicator to be of any earthly practical value for this car, should be able to show all of those probable two thousand stations, and not take up any unnecessary room. Beside this, it should be cheap and not require any additional help on the pay-roll, nor add to the cost of repairs. I don't think station indicators are of any value whatever. I've tried them at different

times, and have seen others try them, and they are not needed. Perfect gentlemen in the train service will accomplish all that we need, and perfect gentlemen playing the roles of travelers, and not trying to imitate hogs, will be satisfactory. I did just what Mr. Phillips did with a patented invention once. It was some time ago, and after I had "blew in" all my real estate in my efforts to show those thick-headed railroad magnates how valuable my invention was, and how awfully anxious the suffering public was to see it in use, and failed utterly, I sat down on a pile of ties and gave myself up to deep meditation. A burly "supply man" also sat on the pile of ties, and—Well, you see it is like this, friend Phillips, I don't want to be bothered around my shops with inventors and their patents, unless they can prove to me that their mechanisms will add to my bank account, and show increased dividends. Money is what I want, and anything you may devise that will make more money for me, bring it around. Otherwise stay away. See?

Cross-section paper is used pretty extensively all over our great republic, and has been for a great many years. It comes and goes in the various shop drawing rooms like the tides of the ocean. I have tried it at various times also, and can heartily agree with Cascadilla in all he says. Some people hear a thing recommended by some man who has a reputation of being very scientific, and they immediately adopt it, and go almost bare-naked and hungry trying to do as their scientific friend has advised, without stopping to see if conditions will justify it. Cross-section paper is an excellent thing in its places, but it should not be *universally* used on the drawing board, and the man who would try so to do is a "hobbyist," and would sacrifice ten dollars any time rather than forsake his little horse. He is neither scientific nor successful as a manager. There are too many small hobby horses in the lanes and alleys of mechanical dividends and profits. THE OLD MAN.

Engineers in the Navy.

Editor American Machinist:

I have followed the discussion in your paper regarding officers in the American navy. I am an old marine engineer, merchant service (over thirty years), and I am very certain that any officer going into my engine room and taking one of my men from work that I had ordered some one would get hurt, and it would not be me (I am a very quiet man). In your last issue I see comments on having scientific engine designers in charge of engines. Well, I have had a little experience with such men, and the result has not been very much to their credit; in a tight place where a practical engineer would have his wits about him, they would get rattled. I hope you will not let the matter drop, but continue to show the matter in its true light. In my opinion the discipline must have been very poor on that ship.

S. S. M.

Annealing Mushet Steel.

Editor American Machinist:

In your issue of February 23, C. E. Simonds gives some of his experiences with mushet steel, and while the subject is under discussion I would like to give you a little of my experience in the same line.

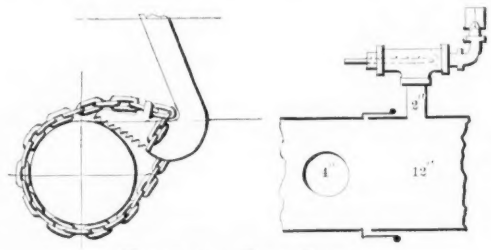
I had some cutters to make for boring bars, and as they were to be used for first cutters only, I wished to use mushet if possible, and annealed it so it could be worked almost as easy as tool steel, in the following manner: After experimenting with one piece, I took twelve and heated them to a forging heat, and put them in a kettle of sawdust, not allowing one piece to touch another; in this they remained for three days, or as long as they kept warm, and when I had taken them out they were so soft I could work them nicely. They were hardened again by heating and cooling off in the usual way; they worked as well as though they had never gone through the process, and are working yet for all I know.

Denver, Colo. C. D. MICHENER.

Pipes and Pipe Joints for Pumps.

Editor American Machinist:

Reading Mr. Crane's experience with a suction pipe with bell and spigot joints, recalls my own. It was a 12-inch pipe for a pair of Worthingtons, 1,100 feet long, and for 700 feet was buried 16 feet deep in sand and gravel. There was trouble from the start by the pumps frequently losing the water. The pipe was put in by contract and was supposed to be a good job, although it was not tested before being covered up as sheet piling had to be driven, and the material was moved and used over as fast as a section was laid. As an expedient I attached a steam jet to the top of the pipe near the large pump, and used it to take out the air at that point, and it worked all right. There was also a tank pump attached to a 4 inch branch from the side of the 12 inch suction, and at a moderate speed it would work all right, but try to run it fast and it would lose its water at once. I attributed this to the air in the top of the pipe being sucked down in little eddies or whirlpools when the



PIPES AND PIPE JOINTS.

pump was run fast enough to make a swift current in 4-inch branch. Finally, after a vexatious delay in the time of a fire, the pipe was dug up and about 50 feet exposed at a time, a pressure put on, and all joints calked up tight. Twenty four small leaks were discovered and stopped, after which there was no further trouble.

I am of the opinion that there is no objection to bell and spigot suction pipes, provided the joints are well and carefully made. They are especially convenient for laying in trenches, as they admit of considerable deviation from straight lines, which cannot easily be had with the larger sizes of wrought-iron screwed pipe. I have one 6-inch galvanized iron suction pipe from a group of driven pipe wells that is good and tight after fifteen years' use. But such pipe is expensive and difficult to lay in trenches. I found it necessary to bend the handle of chain tongs, as shown in sketch, in order to make them work satisfactory.

PETER H. BULLOCK.

A Squeaking Crankshaft.

Editor American Machinist:

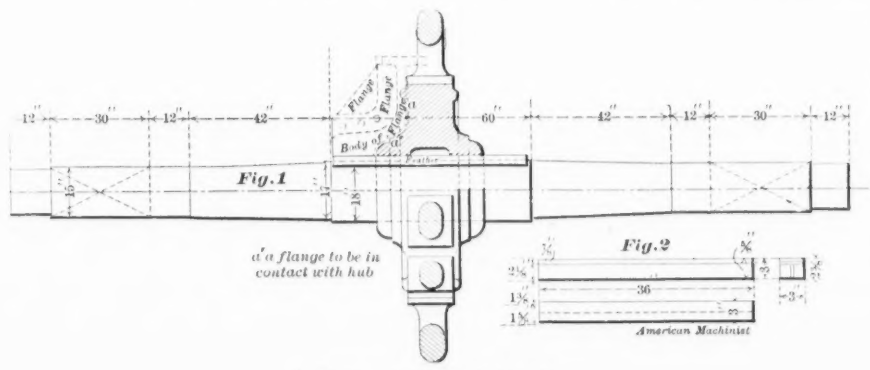
Here inclosed you will find a blue-print representing the shaft of a large pair of engines, and the hub of the main driving pulley, which is grooved for rope transmission. The engines are 32" diameter and 60" stroke; they are at present making 60 revolutions per minute, and developing, according to cards taken, about 750 horse-power; the steam usually carried varies from 75 to 100 pounds per square inch. The power of the engines is greatly in excess of that required at present, and the question of economy in fuel cuts no figure in the case. The reported weight of the wheel is 80,000 pounds. When this steam plant was contracted for, according to the records left, the engines were to run 70 revolutions per minute and indicate 2,300 horse-power. Their speed was reduced for cause about eighteen months ago.

On December 3d, 1892, I was called to pass an opinion upon a squeaking noise that had appeared a few days previous. Having stopped the engines and made an examination of the shaft, hub and wheel, I started the engines again, allowing them to do their usual work for some time, when I stopped their work, letting them run idle.

Shortly after that they were stopped, and another examination made, after which I became fully convinced that the shaft was defective, the appearances being similar to a shaft loose in its coupling. A verbal report, in accord with above, was made to those interested, stating at the same time that the proper course to follow was to strip the wheel, remove the hub, ascertain the facts, and make the repairs wanted, but such decision received no support.

The following day an attempt was made to remove the key, or rather the feather, for such it was, but failed. Being again consulted I advised to drill the feather, which was done and its removal accomplished. Once that done a light was introduced in the seat; the hub is 32" long, and after such examination as could be made by the mill people, they decided that the shaft was O. K., and the only thing to do was a new key, and put it in place. It being intimated that the hub was loose on the shaft I blocked the wheel, the feather being removed, set one of the cranks vertically, and admitted the full pressure of steam (about 75 pounds). I then repeated the same operation on the other side, but without result. When the feather was removed it could be noticed that the fitting had been indifferently done; this led me to conclude that the hub had been shrunk on the shaft. As there was no taper in the key-way, and as it was not desired to extend the key-seat on the cone part of the shaft, I decided to make the key in three parts, as shown in Fig. 2, it being possible thereby to make the key tight on all sides, and to introduce it in its place without difficulty. Before driving the key in its place I took measurement and could discover neither bend nor flexure in the shaft.

On the 9th, the repairs being completed, the mill was started in the morning at the usual hour, and everything was found apparently in perfect order, all squeaking having ceased. Towards evening a slight noise developed itself again, but was stopped by driving the top key one-quarter of an inch



A SQUEAKING CRANKSHAFT.

more, stopping again all noise. On the 10th the same trouble again made its appearance and with greater intensity. On the 12th it was decided to take the wheel apart and commence the making of a new hub so as to gain time, in case it should be wanted. The work of dismantling the wheel had proceeded but a short time when superior orders were received commanding to run the mill.

Supposing that there might be a defect in the new key, after considerable difficulty it was removed, when it was ascertained that the fit was perfect on all its sides, the small end of the top piece only showing a slightly tighter fit, probably due to the sledging necessary to remove it; after having carefully filed the battered ends of the several pieces forming the key, and the top end of the small end of the top piece, the key was again driven home under the direction of the engineer in charge. Prior to this last driving of the keys, in order to make sure that the hub was not loose on its shaft, the mill engineer repeated the first operation mentioned above, and that, too, without success.

This time the squeaking was present again from the start and has never ceased. As it may be readily imagined, advice has been sought from all quarters, and with each advice different views expressed, which to the owners they were more bewildering than at the beginning.

On the 17th an expert with a crew of mechanics and laborers started to remove the key made by me, at 8 P. M., and kept banging at it until 2 P. M. the next day. At that time they were using a ram 5" diameter, 16 feet long, with a heavy coupling at the outer end. Shortly after that the job was given up in disgust, the expert remarking to his foreman that he thought that if the *hub was calked on and round the shaft all the trouble would be at an end.* Of course the hub is cast-iron.

Since that day the mill has been running every working day until January 11th, 1893, with the same squeaking noise but slightly increasing, and the only phase of importance that has appeared lately is the throwing off of thin bright flakes of iron at each end of the hub, as reported by the engineer in charge, who is a very intelligent man and fully competent to fill his position. While from the beginning my opinion has been that the shaft was defective the proof seems to me even stronger to day, and I do not see any reason to change it at this writing.

I would have sent the foregoing description before this, but was waiting to see what decision in this matter was to be taken, when, if the wheel was stripped, the trouble could have been discovered. Contrary to my expectations the mill managers decided to put a flange on each side of the present hub, which is not to be disturbed, each flange being made in halves, and to be bolted through and through with bolts $2\frac{3}{16}$ outside diameter. Said flanges are to extend over the hub, and also clamp the arms and meet between them. While at present I do not propose to criticise the plan nor its details, and that I may readily admit that such considered as a clamp, if properly fitted, may add to the general safety, yet when it is considered that the additional weight will be nearly 30,000 pounds, the ultimate good looks to me very doubtful.

I trust the foregoing will give a pretty good idea of the importance of the matter, and what I desire to invite is friendly criticism from brother engineers, and state where I may have been in error, and what course should have been best to follow in ascertaining the trouble, and finding the unknown quantity—the squeaking.

I should have stated before this that the engines run as cool as before. The dotted lines show approximately the form of the flanges; their thickness is to be about 3" on the sides; the hub 9"; at the outer edge is to be a projection for wrought-iron rods to bind the outer rim to the hub. X. Y.

The Wire Gauge Question.

Editor American Machinist:

In the article by me upon the wire gauge question, upon page 9 of your issue of March 2d, I intended to show that my scheme for a thousandth of an inch gauge agrees in general principles with what is called in England the "Whitworth gauge," but does not, like it, arrange an arbitrary sequence for the different sizes.

At the time, however, when I first proposed this scheme at the Erie meeting, I did not know of the existence of the Whitworth gauge in question. I have not yet found out to what extent it is used in England, but have never heard that it has been adopted for practical commercial work.

OBERLIN SMITH.

It has been decided to hold the naval review at New York on the 27th of April. The rendezvous will take place in Hampton Roads on April 17.

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Subscriptions received in Paris, France, by E. Terquem, 31 Boulevard Hausmann, at 20 francs per annum, postpaid.

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NEW YORK, MARCH 16, 1893.

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Some Machinery Trusts.

A type-writing machine trust or combination is said to be well under way, and it is now announced that the manufacturers of sewing machines are about to form a combination, with the object ostensibly of reducing or doing away with some of the present expensive methods of conducting business made necessary by competition. This, of course, is the old story.

No one pretends to deny that great economies can be introduced by a combination, which is sufficiently strong to prevent the familiar spectacle to be seen in every village of three or more sewing machine wagons hitched to the fence in front of one small cottage, the dweller in which has intimated, in an unguarded moment, that her machine sometimes skips stitches, and she thinks she will some day trade it off for a new one. The expense of all this must be paid by some one, and, in the main, it is, of course, paid by the consumer; but if the expense is done away with, the consumer continues to pay the same prices, and with much reduced, if not entirely eliminated chances of any reduction—competition, practically the only stimulus to reduction, being removed.

It is very true that there is a considerble number of people who are glad to see these combinations forming and increasing in strength, since they believe that these will finally be re-combined into one vast trust or company, which will be taken possession of by the people, and competition entirely removed.

It is our belief, however, that competition is healthful and necessary to development, and that with equal opportunities to go to work and earn a living proportioned to individual ability, there would be very little to complain of in it.

As we have said before, however, we do not think it is practicable for machinery builders generally to form trusts. We do not think the nature of their business permits it, and it is yet to be seen whether or not the conflicting or rather competitive interests of the various sewing machine and type-writer manufacturers can be harmonized by means of such an organization. The nearest approach to it is the organization of the governor manufacturers, which, so far as can be seen from surface indications, is running successfully, and has been doing so for two or three years.

Engineers and Machinists.

In the development of operative railroading which is now going on, it is apparent that the position of the locomotive engineer is undergoing a considerable change. The tendency seems to be toward making him less a mechanic, to relieve him of the care of mechanical matters connected with the machine he operates, and to concentrate his attention upon simply getting the desired or the best possible results from its use while on the road. His services in respect to the implement he uses have, in fact, been likened to those of a soldier who is not required to know anything of the construction or repair of the gun he uses, but only how to shoot it. So with locomotive engineers; there are those who claim they should have little to do with the machine except to drive it over the road, and that the knowledge of signals, running rules, and of the science of the management of the machine is all that ought to be required or expected of one man.

In fact, there are those who go so far as to claim that a machinist is disqualified from becoming a good locomotive engineer, chiefly because his knowledge of and interest in the mechanism of the engine leads him to think too much of his machine, and too little of getting it over the road, and keeping out of others' way.

If this view is to prevail, however, and universal practice becomes in accordance with it, there may be some difficulty in securing good material for master mechanics and superintendents of motive power, who should, we think, be practical and thorough mechanics, as the first and most important requisite; after which, if they have had experience on the road, so much the better.

We do not think that in these days of scientific railroading a knowledge of the machinists' business makes a man a competent locomotive engineer, any more than being a good engineer makes a man also a machinist, but we think that the possession of either art does not prevent a man from acquiring the other, if he is otherwise qualified to do so; and while we recognize the fact that there have been and are some successful master mechanics and superintendents of motive power lacking either the running or the shop experience, we think every one of these would have been still better if experienced in both, and that for the majority such all-round experience is necessary, with the preference for the shop experience, if only one branch can be acquired.

A Proposed New Organization.

A new organization of railway employes is under way, which in many respects differs radically from any of those which have preceded it. The new organization is to open its doors to all who work for railroads in any capacity whatever, and is to be exclusively a business—in no sense a social organization. There is to be only a nominal expense connected with it for dues, no secret meetings, and no meetings at all except for the transaction of business, no insurance schemes, and no officers with high and mighty titles. Its projectors propose forming a conservative organization which shall avoid trouble and strikes so long as possible, by any fair means, the last of these, perhaps, arbitration. It is thought by many railroad men that the new organization will swallow up the older ones, as indeed it is said to have already done in the case of one or two of them.

It is pointed out that most of the older organizations have black-balled and refused admission, and expelled a sufficient number of men to make a large body of active enemies who are able to do much mischief in time of trouble. The formation of an organization which is to be a purely business affair and in which any one working for a railroad can claim membership as a right, is expected to overcome this difficulty. If managed conservatively the new organization bids fair to make its influence felt upon our railway lines. In fact, its greatest danger will probably lie in the fact that its great power may tempt those who guide its destinies to misuse that power.

It is probably true that it is not so easy for a man of limited means to make a successful start in a manufacturing business as it was twenty-five years ago. That is what everybody says, and hence it must be true. Still, if one notes the number of sharp, go-ahead machinists who have grown up to a business of good proportions during the past ten or twelve years, he will almost believe that the old adage is not applicable to men of that trade. There is less chance for men who do not understand the business they try to start—let it run itself, as it were—but the live, energetic mechanic, who has capital in the way of brains to work with, the man who in addition to mechanical skill and ability has, or acquires, good business qualities, seems just as likely to get ahead with a small capital now as ever. He will build up a business because he has something to build it on, and the determination to go on. His shop may be small at the start, but there will be all the more energy distributed over a given number of square feet. The growing up—spreading out—is only the natural result of energy confined in too narrow limits.

A few years ago it seemed probable from the remarkable number of car manufactories going up here and there, that every railroad in the country would soon be fully supplied with cars. But taking the word of those who presumably know, there seems to be the same old lack in this respect—a lack on most of the roads that seriously cripples shippers at certain times of the year. Still it does not look as though there was special inducement for the building of more car shops. If the railroads patronized those already in existence to the extent of their capacity, the roads would probably soon have plenty of cars, and car manufacturers would be made, temporarily at least, happy.

Literary Notes.

THE "PRACTICAL ENGINEER" POCKET-BOOK AND DIARY. 1893. Edited by W. H. Fowler, Wh. Sc., M. I. M. E., A. M. I. C. E. Second Edition.

This is an excellent pocket companion for engineers, draftsmen, and practical men. It contains many tables and useful information, such as can be made use of in the ordinary daily practice. It is compiled after the plan of the many engineers' pocket-books now in use, but on account of the limited space the matter is much condensed. It also contains an almanac arranged for the insertion of notes, etc. Its pages bear evidence that the whole has been carefully compiled, and that the tables, rules, and general information are reliable. We noticed only one slight error on page 25, where it gives the standard horse-power of boilers adopted by the judges at the Centennial Exhibition at Philadelphia, at 30 pounds of water per hour evaporated at 70 pounds pressure from water at 212 degrees, which should have been "from water at 100 degrees." Or, to be more explicit, the commercial horse-power is equal to an evaporation of 30 pounds of water per hour from a feed-water temperature of 100 degrees Fahr. into steam at 70 pounds gauge pressure, and which is considered equal to 34½ pounds of water evaporated from a feed-water temperature at 212 degrees Fahr. into steam at the same temperature.

The book is published by the Technical Publishing Company, limited, 6 Victoria Station Approach, Manchester, England. Price, 1 shilling and sixpence, net.

LOGARITHMIC TABLES. By Prof George William Jones of Cornell University. Fourth Edition.

Besides the admirably arranged logarithmic tables, this book contains tables of constants, weights and measures, sines and tangents of small angles, trigonometric functions, natural and logarithmic; prime and composite numbers, squares, cubes, square roots, cube roots, reciprocals, quarter squares, Bessel's coefficients, and binomial coefficients.

All these tables are well arranged for rapid and easy use. The typography is excellent. The type is clear, and of such variety, large and small, as to give prominence and distinction to figures, so that they may be readily found without straining the eyes; in fact, these tables are models of convenience. They are well adapted for use in physical laboratories and class rooms, and well suited to the wants of teachers, students, and all who have occasion to refer to tables of this kind. The book gives evidence that great care has been taken to avoid errors, and to make the whole reliable.

It is published by George W. Jones, Ithaca, N. Y. Price, $1.

Messrs. Spon & Chamberlin, 12 Cortlandt street, New York, have issued a very handy sketching book for engineers and draftsmen. The pages, 8x5 inches, are very accurately ruled, in blue, to eighths of an inch. The book also contains tables of fractions converted into decimals, areas of small circles up to one inch in diameter advancing by 32ds, and the average weight of various metals. Those who have to make many sketches, or wish to keep sketches for future reference, will find this a very handy book for the purpose.

The New York Railroad Club has issued in very convenient pamphlet form "Topical Discussions" at the meeting of February, 1893. It will prove invaluable reading for those interested in railroad matters. The secretary's address is John A. Hill, No. 5 Beekman street, New York.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(113) C. A., Philadelphia, Pa., sends us a sketch of a reducing motion for an indicator. It is similar to the ordinary motion, consisting of a reducing lever, pivoted at the upper end, and is connected direct to the crosshead; this, of course, necessitates a slot in the lower end of the lever for the pin, which is fastened to the crosshead to work in; the upper pin in the same lever, to which the indicator cord is attached, also works in a slot in the lever, and is guided in a straight path parallel to that of the crosshead. Our correspondent asks: Is this a correct proportional reducing motion? I claim it to be a more accurate reducing motion than that of a pantagraph? *A.*—Your attachment will give a correct proportional reduction of the crosshead motion.

(114) J. P., Bloomfield, N. J., writes: We have lately been making extensions to our factory, and have some difficulty with the belt transmission, owing to the new shop being out of line with the old shop from which we obtain our driving power. We are driving with a 6-inch belt from the first driving shaft in a second-story room across the room to a countershaft, then through the wall to another building on the ground floor. Now the two buildings are out of line 4 feet in 50 feet. Please advise as to the best method for transmitting the power from one shaft to the other two shafts? *A.*—You have not given us sufficient data for advising you correctly; from the meager data you have given, it seems to us that guide pulleys for the belt leading into the new shop should overcome your difficulties.

(115) O., Sacramento, Cal., asks: Which type of stationary engine do you consider the most economical, fuel considered, a simple condensing engine or a compound non-condensing engine? *A.*—With the same boiler pressure for both engines, the simple condensing engine, of good design, will be more economical. But in many localities a condensing engine cannot be used; in such cases the compound non-condensing will be a good type to adopt. 2. What consumption of steam per horse-power, per hour, would be considered good practice for each of the types? Air pump to be worked from the main engine. *A.*—That depends much on the size of engine and on the general design of engine. There are condensing engines which run with 18 pounds of steam per horse-power, per hour, and there are others which use considerable more. For well constructed engines the simple condensing engine will use a little less steam than a compound non-condensing engine.

(116) W. K., Centerville, Ia., writes: Kindly inform me how to find the power required to stove a collar $2\frac{3}{4}$ inches outside diameter and $\frac{1}{2}$ inch thick on a mild steel shaft $1\frac{1}{2}$ inches diameter. Also give formula for finding the weight of drop and height through which it has to fall to give the required blow. *A.*—We referred these questions to Pratt & Whitney Co., manufacturers of drop hammers, etc., Hartford, Conn., who reply as follows: We understand by the expression "stove a collar," that your correspondent desires to upset a collar $2\frac{3}{4}$ inches diameter by $\frac{1}{2}$-inch thick, using mild steel $1\frac{1}{2}$ inch diameter under a drop hammer. The conditions of distance from end of shaft might enter into the problem, and also the time in which the work is to be done, either in one blow or several. A 600-pound drop hammer, such as we make and use for work of this kind, up to collars on $2\frac{3}{4}$ round steel, falling 4 or 5 feet, and in several blows, does the work well. The intensity of the blow can only be expressed in terms of the weight into the distance dropped in feet, foot-pounds or foot-tons, as the case may be.

(117) J. I. P., Newark, N. J., writes: Please give me rules for changing the pulleys on shafts to suit different speeds? *A.*—Let D denote the diameter in inches of a pulley on a shaft, and S the number of its revolutions per minute; also let d denote the diameter in inches of another pulley to which motion is transmitted by the first pulley, and let s denote the number of revolutions per minute of this second pulley. Now in every case we have

$$D \times S = d \times s.$$

This is a very simple formula to remember, and will serve for computing any one quantity when the other three are given. For instance, the diameter D of a pulley is 50 inches, the number of its revolutions S is 120 per minute; the number of revolutions s of the other shaft is 200; what should be the diameter d of the other pulley? Substituting for the symbols their values, we have

$$50 \times 120 = d \times 200,$$

$$\text{hence, } d = \frac{50 \times 120}{20} = 30 \text{ inches.}$$

Again, the diameter d of a pulley is 30 inches, its number of revolutions per minute is 200; the diameter D of the other pulley is 50 inches; what will be its number of revolutions? Here we have

$$50 \times S = 30 \times 200,$$

$$\text{hence, } S = \frac{30 \times 200}{50} = 120.$$

In a similar way any one of the quantities can be found when the other three are known.

(118) J. C. W., New York, writes: Kindly give me an explanation of the following problem: In a triangle $A\,B\,C$ draw $D\,E$ parallel to the base $B\,C$, cutting the sides of the triangle in D and E, so that $D\,E$ shall be equal to $D\,B$ plus $E\,C$. *A.*—Let $A\,B\,C$, Fig. 1, be the given triangle. Prolong the base $B\,C$ towards G, on this base line lay off from C a length $C\,F$ equal to the side $A\,C$; from F lay off on the same line a distance $F\,G$ equal

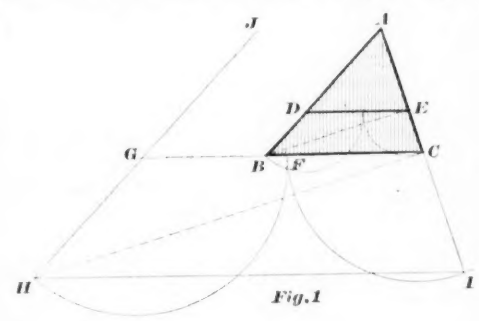


Fig. 1

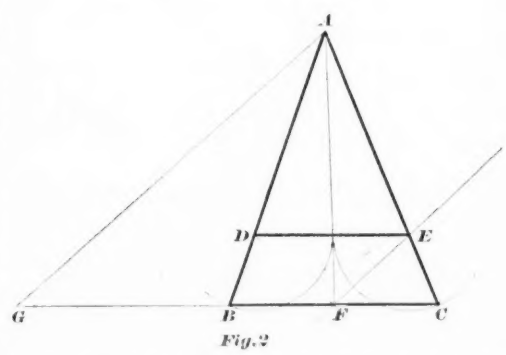


Fig. 2

to the side $A\,B$; this will make $C\,G$ equal to the sum of the sides $A\,B$ and $A\,C$. Through G draw a line $H\,J$ parallel to $A\,B$. From G as a center and with $G\,F$ as a radius draw an arc cutting $J\,H$ in H. Prolong $A\,C$ towards I, and from C as a center and with $C\,F$ as a radius draw an arc cutting $A\,I$ in the point I. If correctly drawn the points H and I will lie in a line parallel to the base $B\,C$. Join C and H by a straight line, and through B draw a line $B\,E$ parallel to $H\,C$, cutting $A\,C$ in the point E; through the point E draw $D\,E$ parallel to the base $B\,C$; then $D\,E$ will be the required line, and is equal to the sum of $D\,B$ and $E\,C$. If the triangle is an isosceles triangle, as shown in Fig. 2, the construction becomes very simple, thus: Let $A\,B\,C$ be the given triangle; draw the altitude $A\,F$, make $F\,G$ equal to $A\,C$, join A and G by a straight line, and through F draw a line parallel to $A\,G$, cutting $A\,C$ in the point E. Through E draw $D\,E$ parallel to the base $B\,C$; then $D\,E$ will be the required line; it is equal to the sum of $B\,D$ and $C\,E$.

(119) Diogenes, Bradford, Pa., sends us a sketch of a steam pressure gauge whose form is similar to that of a syphon gauge, one branch being connected with the boiler, the other branch being closed on the top, inclosing a volume of air above the mercury or other heavy liquid, which fills the lower end of the tube, the whole forming a compressed air manometer. Our correspondent asks: Is such a gauge new? And if not, why are they not in general use? *A.*—This type of gauge is not new. Although the principles of construction of this gauge are correct, it has defects, as usually constructed, which have prevented its general use as a steam gauge. Among these defects are the coating and consequent opacity of the glass tube, by the deposition of an oxide of mercury when acted on by the inclosed atmospheric air; the expansion and partial loss of air from within the tube whenever any partial vacuum is produced in the boiler, and so allowing the mercury to rise higher in the tube with the same pressure; the almost constant tendency of the condensed steam to insinuate itself between the mercury and the glass, and to find its way into the tube above the mercury; and the great inequality in the divisions of the scale, arising from the law that governs the volume of aeriform fluids under pressure. In Appleton's "Cyclopedia of Applied Mechanics" you will find illustrations of gauges of this type, and of improved forms designed to correct the above defects.

(120) Subscriber, Lancaster, Pa., writes: We have a slide valve engine $6\frac{1}{2}$ by 9 inches cylinder, running at the rate of 200 revolutions per minute. The consumption of fuel is 4,500 pounds of pea coal for six days. Engine is run 10 hours per day. We think this entirely too much fuel for the work done. *A.*—With a mean effective pressure of 50 pounds the engine will develop 15 horse-power, which gives 5 pounds of coal per horse-power per hour. This we believe to be a good record for so small an engine, and is all we should expect to get. 2. The inclosed sketch shows the method adopted in laying off ports and valves, as published by you in the AMERICAN MACHINIST, May 1st, 1890. In that article you advise a port area of $\frac{1}{10}$ area of piston for a piston speed of 600 feet per minute, and for higher speeds larger in proportion. You say nothing about slower speeds. The piston speed of this engine is 300 feet per minute, and we have given a port area of $\frac{3}{8}$ of what you say is customary for 600 feet. Is this area too large? Ports are $\frac{1}{2}$ by $4\frac{1}{2}$ inches. *A.*—For speeds less than 600 feet per minute the port area should be made proportionally less than $\frac{1}{10}$ of the piston area. From the foregoing data the following simple rule has been deduced: Multiply the square of the diameter of the cylinder in inches by the speed of piston in feet per minute, and divide the product by 7,639; the result will be the area of the steam port. Applying this rule to your case, we have:

$$\frac{(6\frac{1}{2})^2 \times 300}{7{,}639} = 1.65$$

square inches for the area of the steam ports, and if these are $\frac{1}{2}$ inch wide, then a length $3\frac{1}{2}$ inches will be sufficient. In small cylinder castings it is sometimes difficult to get steam ports of uniform area; if these should be in any way contracted in places which cannot be easily reached, then dimensions of the ports as given by you are not out of the way. 3. Have we made any errors in the sketch? *A.*—No. 4. What size of steam pipe would you recommend for this engine? *A.*—A steam pipe $1\frac{1}{2}$ inch inside diameter will answer the purpose.

(121) V. W. K., Fremont, O., writes: Please explain the following which I have taken from a technical publication: "The relative torsional strength of shafting varies as the cubes of the diameters. Thus, for instance, the torsional strength of a four-inch shaft is just eight times as much as a two-inch shaft, because the cube of 4 is eight times greater than the cube of 2. That is a feature that greatly puzzles the mechanic who does not study the science of mechanics. He recognizes that there is four times the volume of iron in the four-inch shaft that there is in a two inch, and is willing to allow four times the strength, but cannot understand how it can be eight times stronger." It is the last paragraph that I wish to have explained. *A.*—When a shaft is subjected to torsion, the stresses between any two of its cross-sections are similar to those of shearing. If we now suppose a cross-section to be made up of a number of elementary areas, each area is subjected to a shearing force, and the resistance which each elementary area can offer will increase with its distance from the center of the shaft, or, in other words, each small area will act with a leverage equal to its distance from the axis of the shaft. This indicates that the resistance of the shaft to torsion does not increase as the cross-sectional area of the shaft, but in a ratio greater than this. Without going into any demonstrations for obtaining the rule for computing the torsional strength of the shaft, it is sufficient here to simply state the rule. Assume a shaft to be fixed at one end and a force acting on the end of lever attached to the other end of shaft, we then have

$$P \times l = .196 \times f \times d^3,$$

in which P is the force in pounds acting on the end of the lever; l, the length of the lever in inches; f, the working stress per square inch of cross-section, which for shafts, as given by Rankine, is 5,000 pounds for cast-iron and 9,000 pounds for wrought-iron; and d the diameter of the shaft in inches. This formula shows that the strength of the shaft (within the elastic limit) increases as the cube of the diameter. If we have two shafts, one 4 inches diameter, and the other 2 inches diameter, then the comparative strength of these two shafts are as $4 \times 4 \times 4 = 64$, and $2 \times 2 \times 2 = 8$, which shows that the first one is $\frac{64}{8} = 8$ times stronger than the second. But the cross-sectional areas of these shafts increase as the square of the diameters; hence these cross-sectional areas are as $4 \times 4 = 16$ and $2 \times 2 = 4$, which shows that the area of the first shaft is $\frac{16}{4} = 4$ times as great as that of the second.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's Gear Advertisement is always on page 11.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

Forming Lathes Mer. Mach Tool Co., Meriden, Ct.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

Norway Rivets, Evans & Robertson, Cincinnati, O.

6-Spindle Turret Drills A. O. Quint, Hartford, Ct.

Ideal Drill Grinder. Thos. Hall, 853 B'way, N. Y.

"Bradley's Power Hammers, the best in the world." 30 sizes. Bradley & Co., Syracuse, N. Y.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core Randolph Brandt, 38 Cortlandt St., N.Y.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Engine Castings, Humphrey's Foundry, Bellefontaine, O.

Clayton Air Compressor Works, 43 Dey St., N. Y. Compressors for experim'ts to 300 lbs. pressure, $50.

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt Newark, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Most sensitive and durable Damper Regulator made; works within one pound. Send for circular. T. Kieley, 11 W. Thirteenth Street, New York.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., corner Canal and Washington Sts., Chicago, Ill.

Combination, duplex and special gear cutters in stock and to order. vertical milling machines. R. M. Clough, Tolland, Conn.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

20" lathes—24"x24" planers. Write for price before buying elsewhere. F. C. & A. E. Rowland, New Haven, Conn.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Pattern Making.

BY P. S. DINGEY.

SCREW PROPELLERS.

Imagine a cylinder similar to that in Fig. 183 [page 10], whose diameter is A; the curved line from a to b on the periphery represents the thread of a screw which goes exactly once around this cylinder, starting at a and ending at b; the distance from a to b is the *pitch*. Now if a right angle triangle be constructed, whose base equals the circumference of the above cylinder and the height equal to the pitch, the hypothenuse of the triangle will represent the thread from a to b unwound; that is to say, if a piece of paper is cut the same shape as the triangle and wrapped around the cylinder, then $a\,c$ would develop the thread on its surface. To continue the thread space off the pitch as many times as may be needed from a, and draw lines parallel to $a\,c$ as shown by dotted line B; then d will meet a when wound around the cylinder, thus making a continuous thread.

This simple method is the one used for marking the thread on the pattern for a

worm pinion, and which some pattern makers regard as a very profound bit of wisdom that should not be allowed to become too common by "telling."

The line of the thread on the drawing, as shown in Fig. 183, is of no value for a working drawing; but the manner of developing this curve is given for the benefit of the beginner. It will be readily understood without explanation, by referring to the cross lines which are numbered.

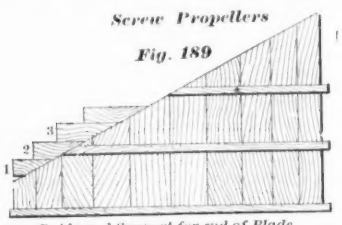
If a three or four-blade propeller is wanted, a pattern for one blade is all that is generally needed, in which case the molder rams up one blade at a time, moving around the pattern on a spindle.

I have seen whole patterns made for three and four-blade propellers, five and six feet in diameter, which saves much time in molding, but unless the pattern is to be used often, which is not generally the case, it seems to be more economical to make but one blade, especially where pattern storage is limited. This, however, is entirely a matter that circumstance alone can decide, and be that as it may, the same principles here given for building one blade will also apply to a pattern with three or four blades.

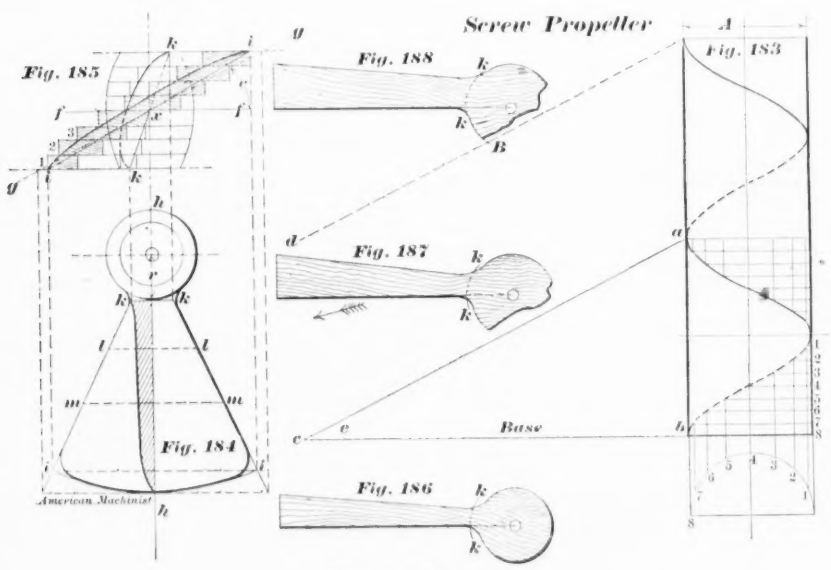
The style of blade chosen to illustrate the manner of building the pattern is that which is used on tugboats and river steamers.

Screw Propellers

Fig. 189



Guide and Support for end of Blade while building



Pattern Making.

Fig. 184 is a plan of the blade, and 185 the end view. Being a true pitch it is an easy matter to get the angle at which to build the blade. First draw *f f*, which shall be the center line of the hub lengthwise; *e*, in the triangle already referred to, is the angle that the blade must be on the end. Let this angle therefore be made at *e*, Fig. 185, by drawing the dotted line *g g* across *f f*; then the point *x*, where these two lines intersect, is the center of the blade, as represented by *h h* in Fig. 184, and through which the face must pass.

Having located the center lines *h h*, *f f* and the angle *e*, proceed to lay out the hub, the outline and longitudinal section of the blade. The section shows the actual thickness through the center of the blade lengthwise, while the outline is not the actual but a projected one. The section across the end of the blade *i i*, Fig. 184, is seen at *i i*, Fig. 185. To get the cross-section of the blade at the hub the angle must first be made. This is done by drawing lines from *k k*, Fig. 184, until they cut the same upper and lower lines as *g g* does. Then *k k* in Fig. 185 will be the angle and section of the blade at the hub; *k k* falling as it does on the round surface of the hub will not appear straight as shown, but it is drawn so in order to simplify the drawing, and as it is intended for a pattern maker's *working* drawing it will answer. The cross-section at *l l* and *m m* is omitted from both views to prevent a confusion of lines.

We now have all the lines that are needed to get the stuff out for the pattern. Care must be taken to get each course of parallel thickness, for if they are not the building up will give trouble and cause the pitch to be wrong. A glance at the face of the blade in Fig. 185 shows we are dependent on the joints as a guide for shaping the face. For the sake of explanation the stuff is cut as close to the line on the back of the blade as it is to the face line, but I would advise that for cutting off there be more stock allowed on the back than is represented in the drawing.

Figs. 186, 187, 188 show the shape of the three first courses 1, 2, 3. The width of each end appears in Fig. 185, and the width at *k k* is obtained by striking a radius on each course equal to *r* in Fig. 184, and then transferring the different widths as seen at the section *k k* in Fig. 185, adding some for fillet.

In getting out the courses the grain of the wood should run as shown in the direction of arrow in Fig. 187; this will make the cutting and shaping of blade much easier than if the stuff were sawed out with the grain running straight.

A wood pin should be turned the same diameter as the spindle, on which the blade will be moved around (say 2¼″), and a hole being bored through the hub part of each course to fit the pin, they are slipped over the pin, thus keeping all the courses concentric.

Though each course may be of even thickness, and the correct bevel laid out on the end of each piece, there is danger in the building up of the courses of their leaning over too much. To prevent this it is a good plan to get out an angle piece as seen in Fig. 189, which is similar to that used when sweeping a propeller. This being cut to the same angle as the triangle in Fig. 183, and made to fit the same circle as the diameter of propeller, it is used as a guide and support for building up the blade. Each course for a short distance in from the end, is beveled off so as to rest on the incline of this angle piece, care being taken not to destroy the upper radial edge in doing so.

While this pattern is shown built face down, with the ends of each course resting on the angle piece, it may be built face up, and by some the latter method is preferred, because it is claimed that the pattern maker can better see to keep the face edges right when they are on the upper side, than on the lower; but this is only a matter of choice.

A correspondent sends us a newspaper clipping giving an account of a railway accident, the cause for which was as peculiar as anything we have read. A runaway horse attached to a sleigh took to the railroad track, and the runner of the sleigh opened a switch, which mixed up a passenger train, that happened along about that time, rather promiscuously between the siding and the main line. Fortunately no one was seriously injured by the maiden efforts of the horse in railroading.

The North Hudson Railway Company has decided to use the trolley entirely. The cable broke a few days ago and will not be mended. John Hanley, the engineer, told a *Journal* reporter that sixteen tons of coal were consumed each day of twenty-four hours in running the cable, but now it requires twenty-four tons a day. He also said that the company was about to put in three large dynamos.—Jersey City *Evening Journal.*

A Chicago dispatch says: The Grand Jury has returned an indictment for murder against Charles D. Law, General Superintendent of the Fort Wayne Railroad. The indictment is the result of the accident at the Forty-seventh street crossing of the Fort Wayne Road, in which four persons were killed outright, and fourteen seriously injured. The charge is not a bailable one, and Mr. Law will be arrested and put in jail.

Now the word is that the electric roads so freely built and building in this country are seriously injuring the steam roads in the matter of suburban traffic, in some instances this traffic between cities and towns having been given up by the steam roads.

General Eckert, who succeeds Dr. Green to the presidency of the Western Union Telegraph Company, has worked himself up from a telegraph operator. There is a lesson in this.

Of 23 unions of skilled workmen reporting to the English Board of Trade for January, out of a membership of 279,577, there were 27,845 out of work.

Manufactures

Bement, Ill., is to have bottling works.

A canning factory is to be started at Colchester, Conn.

The Chewacla (Ala.) Cotton-mills have been organized.

A cheese and canning factory is to be erected at Warrensburg, Ill.

The Pittsfield (Me.) Manufacturing Co. report business very brisk.

A knitting-mill is to be established in Knoxville, Tenn., by Geo. Andes.

The citizens of Macon, Ill., have raised $12,000 to start a canning factory.

A kindling-wood factory is talked of at Winslow's Mills, Waldoboro, Me.

The output of the Columbian Cotton Co. at Greenville, N. H., has been increased.

A knitting factory is to be established in Philadelphia, Pa., by John Wanamaker.

The New England Fiber Co., Turner's Falls, Mass., needs a larger mill it is said.

A street railway company has been organized at Pontiac, Ill., with a capital of $100,000.

A company has been organized at Watseka, Ill., for the manufacture of the Stiles hinge.

The Lincoln Furniture Company, at Lincoln, Ill. has been organized, with a capital of $30,000

The Xenia (O.) factory of the American Cordage Co. is to have new spinning machinery added.

There is a good prospect that a woolen-mill and a pulp-mill will be established on the St. Croix, Me.

Next May the River Spinning Co. will start on the erection of a new mill to their plant at Villa Nova, R. I.

William Sanford is forming a stock company with a capital of $50,000 to start a mill at Cohoes, N. Y.

An addition is being erected to the Middlesex Knitting Co.'s plant at Martinsburg, West Virginia.

The Hanover Distilling Company, of Peoria, Ill., has been incorporated with a capital stock of $100,000.

The Electric Light, Power and Heating Company has been incorporated at Springfield, Ill.; capital stock, $50,000.

The Pekin (Ill.) Boiler Works have been obliged to double their capacity, and a new building is now being erected.

The Sangamon Paper-mills, in Riverton, Ill., have been sold to the Columbian Straw Paper Company, of New Jersey, for $75,000.

The Eames Manufacturing Co. has been organized at Bridgeport, Conn., to manufacture children's carriages. Capital, $12,000.

C. V. Starbird, Strong, Me., is building a sawmill near his present spool-bar-mill. His new mill is for long as well as short lumber.

O. B. Emery, Waterboro, Me., whose grist-mill was lately burned, is putting in a foundation on a new site preparatory to rebuilding.

The McIntosh-Hemphill Iron Co. has been incorporated at Harrisburg, Pa. The directors are James Hemphill, Penrose Hart and others.

F. O. Bailey & Co., of Portland, Me., are to build a sleigh and carriage factory in Deering if the town will exempt from taxes for ten years.

A new company will be formed with a capital of about $50,000, for the manufacture of high-grade paper, to be located at Westbrook, Me.

A steam-mill for the manufacture of finely finished birch products is a prospective new industry for Mexico, Me., on the Androscoggin River, Me.

A stock company has been formed and land purchased for the establishment of a furniture factory at Fort Fairfield, Me. Fifty thousand dollars will be invested.

Sanford (Me.) is agitating the question of forming a stock company for the erection of a building to be leased to reliable parties for manufacturing purposes.

Articles of incorporation were recently filed for the Stewart Coal Mining Company, of Anchor, Ill., which proposes to sink a shaft there. The capital stock is $20,000.

The chair factory at South Waterford, Me., will soon be in shape to start up. An engine room and dry house are being erected, and the piping of the building is under way.

Mr. S. G. Lang is taking the initiatory steps for the formation of a company to build a cotton factory at Sandersville, Ga., and is meeting with substantial encouragement.

The Foster Engineering Company, Newark, N. J., has issued an illustrated catalogue of steam pressure regulators, pump governors, reducing valves and inside safety check valves.

Utica Electrical Manufacturing and Supply Company, Utica, N. Y., has issued catalogue "C," which contains illustrations and descriptions of various electrical devices made at their works.

A company is being formed to start an electric light plant at Closter, N. J. The projectors contemplate supplying light for Harrington Park, Norwood, Closter, Cleveland-on-the-Hill and Tenafly.

E. W. Bliss Company, Brooklyn, N. Y., have given notice that they have reduced the prices on their adjustable power presses Nos. 10, 12, 12½, 18, 19 and 20. These presses are kept in stock, ready for immediate shipment.

The Hunt Soap Manufacturing Company, of Indianapolis, Ind., is making extensive improvements to its plant, putting in new boilers, vats, etc. The business of this establishment has increased fourfold in the last three years.

Capitalists of Ellsworth, Me., organized a company with a capital stock of $8,000, to manufacture a new kind of a spring bed. The officers are: E. H. Greely, president; A. W. King, secretary and treasurer; H. W. Eaton, of Bar Harbor, general manager.

The entire business of the Standard Thread Company, of Newark, N. J., is to be transferred to Springfield, Mass., and part of the machinery has already arrived there. The company is to be located in the Taylor & Tapley Manufacturing Company's block on Willow street.

Work on another mill to contain about 40,000 spindles will be begun at Fall River, Mass., as soon as the ground is fit for operations. The mill will be called No. 3, will be run in the interest of the American Print Company, which is owned principally by Matthew C. D. Borden, of New York.

Cooper Brothers, formerly of West Searsmont, are building a veneer-mill at Newport, Me., 100 feet by 40, two stories in height. The engine and boiler room is 21 by 30 feet. Basswood for sleigh and carriage work will be the main reliance, but later on it is proposed to cut veneers from birch and maple for other uses.

The Hayden & Derby Manufacturing Co., No. 111 Liberty street, New York, inform us that their business in Metropolitan automatic and double tube injectors has been so far this year more than double what it was for the corresponding period last year, and that inquiries from all parts of the country, and from foreign countries, are numerous.

The Lawn Swing Co., Fairfield, Me., commenced last week to manufacture swings for the next season's supply. It is expected that it will take 20,000 to supply the orders, as already they have on file several orders to be filled in the early spring—one order for 800. It will be necessary to enlarge the factory to three times the present size, to meet the demand before another season comes around, if the present outlook can be depended upon.

The Ashcroft Manufacturing Company, 111 Liberty street, New York, has issued a new work on the Tabor Improved Steam Engine Indicator. The work is quite complete, giving an illustrated description of the instrument, and treating in a general manner the application of the indicator, what may be learned from the diagram, working up the diagrams, etc., all made plain by a large number of diagrams and other engravings. Tables of the properties of steam, areas of circles and various

others are given. The work is furnished free to those purchasing an indicator; the price to others is one dollar.

A St. Louis (Mo.) man has invented a new process of steel manufacturing. The process, it is alleged, either pig iron or steel can be made direct from the ore with a gas fuel, and the best Bessemer pig-iron can be made for less than $10, and steel in the billet for $12.50 a ton. It is stated that a company will soon be organized with a capital of $1,000,000 to build a plant in East St. Louis, to manufacture pig-iron and steel by the new process.

The Berlin Iron Bridge Company, of East Berlin, Conn., have secured the contract for the new buildings required by Wm. Cramp & Sons Ship and Engine Building Company, Philadelphia, Pa. The Berlin Bridge Company have lately completed a boiler shop for the Cramps, and now have a contract for all the other buildings required to enlarge their plant. The new buildings will consist of a ship shed 60x100 feet, a blackboard 75x200 feet, and bending shed 86x150 feet constructed throughout of iron; also have just completed a power station 38 feet wide by 112 feet long for the Roaring Fork Electric Light and Power Company, at Aspen, Colo.

The J. A. Fay and Egan Co. (consolidated) write us: "Users of wood working machinery will always have the same opportunity as before enjoyed, in that they can select a machine of J. A. Fay & Co. make, or one of the Egan Company's construction. Entire outfits can be had too as heretofore. The new J. A. Fay and Egan Company, of Cincinnati, Ohio, U. S. A., propose designating each plant formerly occupied by the old concerns as the Fay department and as the Egan department, and both will be run by the same foremen and workmen as in the past. Each department will continue to construct machinery from the same patterns and precisely of the same type, but with improvements which will be added from time to time, thus keeping up the same standard of excellence which characterized the productions of the older establishments."

Machinists' Supplies and Iron.

NEW YORK, March 11, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.75 to $15.25; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $14.75 to $15 for No. 1 Foundry; $13.75 to $14 for No. 2; and $12.75 to $13 for Gray Forge.

Antimony—The market is steady. We quote L. X., 10⅜c. to 10½c.; Cookson's, 10½c. to 10¾c.; Hallett's, 10c. to 10½c., and U. S. French Star, 10¼c.

Copper—The market is weak and irregular. Lake Copper is quoted at 11.90c., 12c. for car loads, but in a large way 11.85c. would buy. Business is light. Casting Copper is held at 11c. to 11¼c.

Lead—The market is dull and easy. Stock in second hand is held at 4c. for immediate delivery, and at 3 95c. for March delivery by the car load.

Lard Oil—Prime City is quoted at $1.05 to $1.06.

Spelter—March delivery is quoted at 4.25c. to 4.27½c. There is no business, and the quotations are more or less nominal.

Tin—The market is firm. March delivery is held at 21.45c., with 21.30c. bid, and the future months are quoted all the way from 21.50c to 21.90c. Very little business is done at current rates.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Salesmen on commission, to push a special line of mach'y. "Kirk," care of AM. MACH.

Head draftsman for marine and general eng. works, wants change. X. Y., AM. MACHINIST.

Wanted—Practical man to sell to mach. shops in N. Y. & vicinity. Good com'n. Box 49, AM MACH.

Wanted—Two die and cap filers. Address Box 50, AMERICAN MACHINIST.

Designer and draftsman, technical graduate, with shop exp., wants position. Box 24, AM. MACH.

Wanted—3 1st class mach. pat'n makers for new shop. Munro, Spiro & Wendler, Carthage, N. Y.

Wanted—A first-class wood pattern maker for plumbing brass work; apply to Ahrens & Ott Mfg. Co., Louisville, Ky.

Wanted—A good mech. draftsman, one who has worked on printing press machinery pref'd; state exp. and wages expt'd. Box 23, AM. MACHINIST.

Wanted—First-class machinist, at good wages; steady employment; must be used to job shop work. Address Box 34, AMERICAN MACHINIST.

Wanted—Position by German graduate and draftsman 4 years' exp. A permanent position preferred, salary moderate. Box 45, AM. MACH.

Wanted—Pattern makers on heavy machinery work. None but 1st class workmen of good habits need apply. Farrel F'd'y & Mach. Co., Ansonia, Ct.

Wanted—Foreman for machine shop for a car works; must be under 40 years of age. Address V. 5, care Lord & Thomas, Chicago, Ill.

Wanted—Position as foreman of shop running 25 to 50 men; well up on jig and interchange methods; references. Address Energy, AM. MACHINIST.

Wanted—Ten machinists (bench hands) and one machine pattern maker immediately Inman Manufacturing Company, Amsterdam, N. Y.

Wanted—Machinery blacksmith that can use power hammer. Also man for heavy lathe, and several floor hands. Box 48, AM. MACHINIST.

Wanted—Vise and planer hands, steady job, men experienced in pump work preferred. Gardner Governor Co., Quincy, Ill.

Wanted—Foreman to take charge of shop manufacturing band hammers of all kinds, sledges, etc. Must be well up in all branches of the work and able to superintend. G. B., AMERICAN MACHINIST.

Mech. engineer exp'd in laying out plans of mach'y, making estimates, and supt'g construction of work, desires engagement as draftsman and ass't. manager or supt. Box 46, AM. MACH.

Mechanical draftsman wanted, one experienced in general machinery to work at Orange, N. J. Address by letter only, giving full experience and references. Edison, Orange, N. J.

Wanted, immediately—Two good molders for dry and green sand work; also good lathe and planer machinists for shop building steam engines. Address Box 40, AMERICAN MACHINIST.

Wanted immediately—A 1st class brass molder who can make models and light work. No other need apply. Best references required. Kirley's Brass Foundry, Utica, N. Y.

An accurate and thorough mechanic, experienced in all branches, has filled the positions of master tool maker, foreman and sup't; is at present disengaged; best of refs. Box 38, AM. MACH.

Machinist of considerable experience in prominent city weaving factory 10 years foreman in present position, desires change about May. Refs. Scotchman, care Carson, 73 W. 96 st., N. Y. City.

Wanted—Steady employment given to a good turret lathe hand in a large, pleasant Ohio town. Must be a temperate man of family and steady habits, and a good workman. Address L. B., care of AMERICAN MACHINIST.

Wanted—One good draftsman and designer of steam engines and general work, must understand the steam engine thoroughly. State age, exp., habits and salary expected, and how soon you can come. Box 300, AM. MACHINIST, New York.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 4, 1886 issue; must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMP. NY, 203 Broadway, New York.

Wanted—Foreman for machine shop manufacturing wood-working machinery; must be a good mechanic, and well acquainted with modern machine shop practice; state age experience, and salary expected. Address I., Box 26, AM. MACHINIST.

Wanted—To correspond with a competent and reliable young man who can take hold of the foremanship of a small and growing shop, and keep up his end so as to eventually merit a share in the business. Address Southern Illinois, care of AMERICAN MACHINIST.

Wanted—A foreman for machine shop in Western Pennsylvania manufacturing portable engine and gen. machine work; must be thoroughly up in modern machine shop practice and understand methods of producing work cheaply; give reference, age and salary expect'd. Box 39, AM. MACH.

Bradley Hammers.

If you plate, draw, square, taper, swage, collar, spindle, or do any manner of die forging in iron or steel, a BRADLEY HAMMER will soon pay for itself, by what it will save over any other similar tool. Send for circulars.

BRADLEY & COMPANY, SYRACUSE, N. Y.

HACKNEY HAMMERS

Meet all requirements more fully and satisfactorily than any other of its competitors.

INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.

WRITE FOR CATALOGUE TO
THE HACKNEY HAMMER CO.
20 Johnson St., CLEVELAND, O.

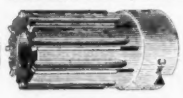
FROM OIL CUP TO CYLINDER. EVERY PART DESCRIBED IN
LOCOMOTIVE CONSTRUCTION.
By J. G. A. MEYER, Esq.
(Associate Editor of *American Machinist*).

CHAPTER I.—Classification of Locomotives—Train Resistance—Tractive Force—Weight of Engines.
CHAPTER II.—Construction of Cylinders—Steam Pipes—Slide Valves.
CHAPTER III.—Valve Gear—Construction of Links.
CHAPTER IV.—Construction of Pistons—Crossheads—Slides—Stuffing-boxes.
CHAPTER V.—Frames—Axle-boxes.
CHAPTER VI.—Driving-axles—Driving-wheels—Counterbalance.
CHAPTER VII.—Main Rods—Side Rods—Crank-pins.
CHAPTER VIII.—Throttle-pipes—Throttle-valve gear—Safety-valves—Whistle—Pumps—Checks.
CHAPTER IX.—Spring Gear.
CHAPTER X.—Boilers—Grate Surface—Heating Surface—Riveted Joints—Extension Fronts.
CHAPTER XI.—Ash-pans—Smoke-stacks—Exhaust-pipes.
CHAPTER XII.—Sand-boxes—Bells—Pilots—Braces from Boiler to Frames.
CHAPTER XIII.—Engine Trucks.
CHAPTER XIV.—Oil-cups—Cocks—Injectors.
CHAPTER XV.—Tenders.
CHAPTER XVI.—Useful Rules—Formulas and Data.
CHAPTER XVII.—Compound Engines.
4to, Cloth, 1030 Illustrations, - - $10.00.

JOHN WILEY & SONS, Publishers, - - NEW YORK.

Philadelphia
Geo. B. Grant's new gear shop is at
125 South 11th St

American Standard Gauge & Tool Works,
WILMINGTON, DEL.

Adjustable  SHELL REAMERS

⅝ inch to 5 inch.
JAMES A. TAYLOR & CO.

Wanted Everywhere. Agents

Nonpareil Ratchet Wrench.

These Wrenches are much more easily and readily adjusted and controlled than any others, can be made reversible instantly without removing from their work by throwing over the lever in slot of the handle.

The Set of Combination Tools No. 1 includes the wrench, two sockets, one for screw-driver, bit or reamer shank, with wood handle for same, and one socket for drill shank and feed nut. The jaws on this wrench open from ⅛ to 1¼ inches.

Send for Illustrated Circular and Price List.

The Keystone Manufacturing Co.,
312 TERRACE, BUFFALO, N. Y.

STEEL TUBES
WELDLESS
SMOOTH · COLD DRAWN
John S. Leng's Son & Co. New York.

Liberal inducements to Agents.

SLIDING CALIPERS are the best Measuring Instrument made, give them a trial and be convinced.

Hardened Jaws; graduated in 1-100th and 1-64th or 1-32d and 1-16th, warranted first-class and accurate.

Vernier and Metric Measurement to Order.

Prices are low *and you cannot afford* to be without one. Ask your dealer for it, or send for circulars and prices to

E. C. SMITH, COLUMBIA, PA.

THE LEADER HACK SAW MACHINE

Perfect Allignment Of Blade.

Will cut STEEL at an angle.

Frame rises on return stroke, saving wear on blades.

SEND FOR LIST.

THE FRASSE COMPANY,
90-94 Park Row, New York City. Near Brooklyn Bridge

THE MASON PUMP GOVERNOR.

The Mason Pump Governor is to the direct acting steam pump what the ordinary ball governor is to the steam engine. It attaches directly to the piston rod of the pump and operates a balanced valve placed in the steam pipe, thereby exactly weighing the amount of steam to the needs of the pump, and economizing the same. By using the Mason Governor, you can instantly set or change your pump to any required speed, which will be maintained in spite of variation in load or steam pressure. As all the working parts of the governor are immersed in oil, the wear is reduced to a minimum. It is largely used on vacuum pumps, deep well pumps, water works pumps, ice machines, and all classes of pumps requiring an uniform strike.

For large duplex pumping engines a special governor is made, fitted with double parts and connected with both piston rods, thus insuring perfect regulation for every portion of each revolution of the engine.

MASON REGULATOR CO., Boston, Mass., U. S. A.

Bowsher's BALANCING WAY

FOR BENCH AND FLOOR USE. 8 SIZES AND STYLES.

A new idea. A time saver. A tool to take the place of the devices in present use for balancing pulleys, armatures, cutter heads and rotary parts of machinery in general. Ways are *chilled* and *ground*. Spirit levels attached. Substantial, accurate, cheap. Send for circular.

N. P. BOWSHER, South Bend, Ind.

WANTED.

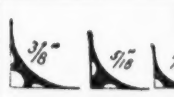
A well established company manufacturing gas and gasoline motors for stationary, marine and all other purposes, on a large scale, is prepared to communicate with parties in each of the large cities, outside of New York, to accept agencies for their motors.

Responsible firms wishing to secure territory please address with full particulars as to standing and references.

MOTOR, P. O. Box 2920, New York City.

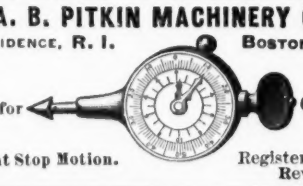
PATENT UNIVERSAL
SCREW-CUTTING
CENTRE, DEPTH, ANGLE,
AND TWIST DRILL GAGE
J WYKE & CO E. BOSTON, MASS
MFR'S FINE MACHINISTS TOOLS.
SEND FOR LISTS
CHAS CHURCHILL & CO., LTD. AGTS.
21 CROSS ST. FINSBURY, LONDON ENG.

Flexible Metallic Fillet



For Pattern Makers. 8 Sizes.
H. WHITE, 44 N. 4th St. Phila, Pa.

THE STANDARD REVOLUTIONS COUNTER
A. B. PITKIN MACHINERY CO.
PROVIDENCE, R. I. BOSTON, MASS.

Send for  Circular.

Patent Stop Motion. Registers 2,000 Revolutions

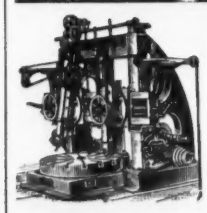
BRASS-WORKING TOOLS,

SPECIAL MACHINERY,

BARDONS & OLIVER Cleveland, Ohio.

PRICES on APPLICATION

SCREW MACHINES.



BORING AND TURNING MILLS

COMBINING EVERY IMPROVEMENT.

14 SIZES—FROM 5 TO 20 FEET.

BETTS MACHINE COMPANY,
WILMINGTON, DEL.

H. W. JOHNS'

ASBESTOS SECTIONAL PIPE COVERINGS.

Non-Conducting Coverings for Steam and Hot Water Pipes, Boilers, etc.
ASBESTOS BOILER COVERINGS.
H. W. JOHNS MANUFACTURING COMPANY,
H. W. Johns' Asbestos Millboard, Sheathings, Building Felts, Fire-Proof Paints, Liquid Paints, Asbestos Roofing, Etc.
87 MAIDEN LANE, N. Y. JERSEY CITY, CHICAGO, PHILADELPHIA, BOSTON, ATLANTA, LONDON.

Wanted—Those in need of a first-class man as foreman boiler maker, one that can turn out first-class work at lowest cost. Address Boilers, care AMERICAN MACHINIST.

Machinist and draftsman (designer) 3½ years in this country, who is master of 4 languages, wishes to represent or act as interpreter for one or several concerns at the Columbian Exhibition; had a similar position at the Paris Exposition of 1889; can give first-class American and foreign references. Address L. E. F., AMERICAN MACHINIST.

Wanted—A competent, energetic foreman or superintendent, to take charge of concern manufacturing a general line of brass and iron steam appliances. Must be a pusher; competent to handle 150 men or more to best advantage; well up in modern shop practice and the methods employed for rapid work. State age, experience, and salary expected. Box 44, AMERICAN MACHINIST.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Gang & Co., Cincinnati, O.

DESIRABLE SECOND-HAND MACHINERY.

PLANERS.

1 40 in. x 36 in. x 10 ft. New Haven.	A1 condition
1 37 in. x 40 in. x 9 ft. Enterprise Machine Co.	Good order
1 28 in. x 28 in. x 7 ft. New Haven.	Good order
1 24 in. x 24 in. x 6 ft. Pease.	Good order
1 15 in. x 15 in. x 3 ft. Wilkinson.	Good order
1 18 inch Crank, Lathe & Morse.	A1 condition

LATHES.

1 24 in. x 12 ft. Cady Engine Lathe.	Good order
1 24 inch, raised to 28 inches, by 8 ft. Cady Engine Lathe.	Good order
2 14 in. x 6 ft. Hendey, Rise and Fall Rest.	Good as new
1 17 in. x 6 ft. Fitchburg, Compound Rest.	A1 condition
1 14 in. x 6 ft. New Haven, Rise and Fall Rest, and Chuck.	Good order
2 26 in. x 25 ft. Pond Lathes, Compound Rest. (Not Screw Cutting	Good order

MISCELLANEOUS.

1 No. 3 Pratt & Whitney Plain Screw Machine.	Good as new
1 No. 2 Brown & Sharpe Surface Grinder.	A1 condition
1 No. 3 Windsor Turret Lathe, Wire Feed, and Automatic Chuck.	Good as new
1 Garvin Single Spindle Profiler.	Good as new
1 24 inch Hendey Friction Shaper.	A1 condition
2 22-inch Gould & Eberhardt Gear Cutters.	Good as new
1 Merritt Heavy Back-Geared Milling Machine.	A1 condition
1 No. 4 Six-Spindle Garvin Drill Press.	Good as new
1 15 in. x 5 ft. Lodge & Davis Plain Turret Lathe.	A1 condition

Write for List of 500 New and Second-hand Tools in Stock.

THE GARVIN MACHINE COMPANY,
CANAL AND LAIGHT STS. NEW YORK.

SECOND-HAND AND NEW MACHINERY

62 in. x 61 in. x 9 ft. Planer 2 Heads.
54 in. x 42 in. x 24½ ft. do 2 do
42 in. x 42 in. x 16 ft. do 1 do
30 in. x 30 in. x 8 ft. do 1 Head.
26 in. x 24 in. x 7 ft. do 1 do
25 in. x 24 in. x 5 ft. do 1 do
24 in. x 24 in. x 5 ft. do 1 do
15 in. x 3 ft. Planer New Haven.
80 in. x 18 ft. Engine Lathe Geared Face Plate.
60 in. x 45 ft. Double Engine Lathe.
52 in. x 35 ft. Engine Lathe Horizontal Boring Machine, one end.
30 in. x 28 ft. Pond Machine Tool Co. Shafting Lathe.
32 in. x 26 ft. D. W. Pond Engine Lathe.
32 in. x 12, 14, 16, 18 ft. Bed. New Engine Lathe.
28 in. x 22 ft. Engine Lathe, cheap.
25 in. x 12, 16, 20 and 24 ft. Bed. New do do
21 in. x 10, 12 ft. Bed. do do do
20 in. x 7½ & 8 ft. do 2d Hand do do
18 in. x 6, 7 & 8 ft. do New & do do do
17 in. x 8 ft. do do do do
16 in. x 6 & 8 ft. do do do do do
15 in. x 6 & 8 ft. do do do do do
14 in. x 6 ft. do do do do do
Car Axle Lathe, Bement. | Driving Wheel Lathe 88 in.
15, 16, 18, 25 in. Crank Shapers. | Wheel Quartering Mach.,
20, 24, 26 & 30 in. Geared Shapers. Double.
20, 22, 24, 28, 30 & 36 in Drills.
Bolt Cutters.
8 and 13 in. Stroke Slotters.
Lot of Lincoln Pattern Millers.
2 Spindle Drills. Garvin.
No. 75 Bliss Press Geared.
Boiler Head Flanging Mach. O'Brien's Gear Molding Mach.
1100 and 3000 lb. Bement Steam Hammer.
100 and 150 lb. Steam Hammer.
40 H. P. Vert. Engine. N. Y. S. S. P. Co.
11 in. x 18 in. Hor. Engine. A1 Order.
12 in. x 24 in., 14 in. x 36 in. and 16 in. x 42 in. Corliss Engines.

No. 0 Turret Lathe, Am. Tool and Mach. Co., 24 in. Swing, 8 ft. Bed.

SEND FOR MARCH LIST.

GEO. PLACE MACHINE CO.,
120 BROADWAY, NEW YORK.

SOFT GRAY IRON CASTINGS.

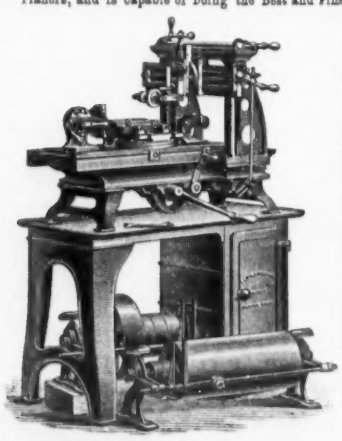
From ⅛ oz. to 1000 lbs. Small Castings a Specialty. Light machinery wanted to build.

ONTARIO IRON WORKS,
CANANDAIGUA, N. Y.

POWER OR HAND PLANER,

FOR MODEL MAKERS, EXPERIMENTAL WORK, &c.

Has all the Improved Features Usually Found on High Grade Planers, and is Capable of Doing the Best and Finest Work.



MANUFACTURED BY
A. J. WILKINSON & CO.,
184 Washington Street, Boston, Mass.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—To buy or rent a small machine shop and foundry; give full partic's. Box 41, AM. MACH.

Speed lathes, 13" and 15" swing, and carriages and slide rests, $30 each. 229, AMERICAN MACHINIST.

For sale, for want of use, Herreshoff improved water-tube boiler in perfect order, 5½ feet by 5½ feet by 6 feet, with usual fixtures; price low for cash. W. H. Hoyt & Son, Box 765, South Norwalk, Conn.

Wanted—Manufacturer for a specialty. The makers of a high class English gas engine wish to arrange with a firm of engineers having suitable premises and plant to manufacture and sell in this country. I. D. Humpidge, Box 136, Riverton, N. J.

Wanted—Agents well equipped to sell a well-known friction clutch; it has no superior in the market. Millwrights, electrical engineers and parties handling shafting can make advantageous arrangements. Box 47, AMERICAN MACHINIST.

Wanted—To sell one of the most complete foundry and machine shop plants west of the Mississippi, located in the best town in the West; this plant is equipped with modern machinery and of large capacity; originally established in 1867; reason, wish to retire from business. R. L. Cofran, Topeka, Kan.

REMOVAL

MAY 1st to

14 DEY STREET.

We will close out at low prices previous to time of our removal the following

SECOND-HAND MACHINE TOOLS.

Engine Lathe, 43 in. x 10 ft. Triple gd.—Screw Feed.	Price, $175.
" " 32 in. x 12 ft. Cpd. Rest and Cross Feed.	
" " 24 in. x 8 ft. Hol. Spin 1⅝ in.	Good.
" " 20 in. x 8 ft. Cpd. Rest and Cross Feed.	A1
" " 20 in. x 18 ft. Cpd. Rest and Chuck.	Good.
" " 18 in. x 8 ft. Complete New Haven.	"
" " 16 in. x 6 ft. " Fitchburg,	"
" " 14 in. x 6 ft. " "	"
Planer 20 in. x 4 ft. Whitcomb.	"
" 22 in. x 4 ft. Wood & Light.	"
" 24 in. x 5½ ft. with Chuck New Haven.	"
" 30 in. x 8 ft. latest heavy pattern.	Used 1 Week.
Shaper 13 in. Crank—heavy pattern.	Good
" 14 in. Fitchburg—latest pattern.	A1
" 15 in. Friction Hendey.	A1
" 20 in. Crank, extra weight and power.	
Slotter 8 in. Modern Style, Auto. Feeds.	A1
Upright Drill, 30 in. Extra power, Bk. gears, Auto. fd. Lever fd. and reverse for tapping.	A1
Gang Drill 3 spindle—Garvin.	Good.
Brown & Sharpe Vertical Turret Machine.	A1
Brown & Sharpe No. 5 Screw Machine, Complete.	
Jones & Lamson Screw Machine No. 11 with 2½ hole, Clutch gears, Auto. fd., Chasing Bar Chucks and Tools.	A1
Bolt Cutter, 1¼ in. full sets dies and taps.	
Punch Presses, Standard Sizes and Styles.	
Boiler Bending Rolls, 8 ft. 2 in. Improved Style with "Hinged" housing.	Good as new.

J. J. McCABE,
SUCCESSOR TO
E. P. BULLARD'S N.Y. Mach'y Warerooms.
68 Cortlandt Street, NEW YORK.

JESSOP'S STEEL

FOR TOOLS, DRILLS, DIES, &c.

ALL KINDS IN STOCK.
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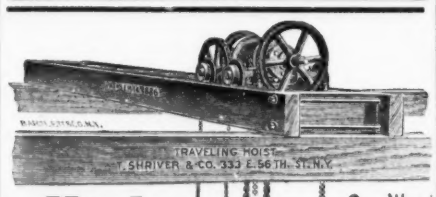

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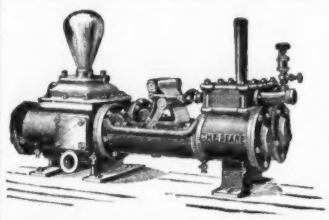

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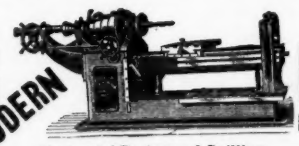

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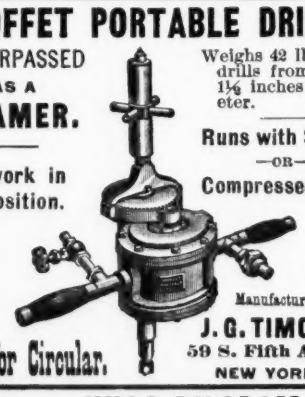

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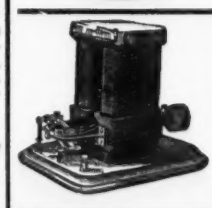

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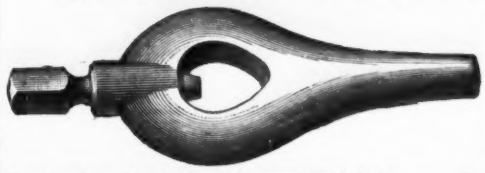

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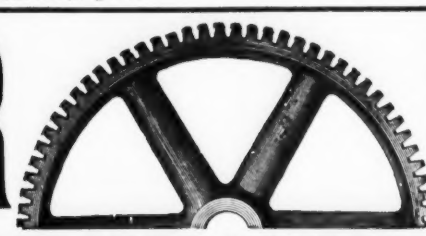

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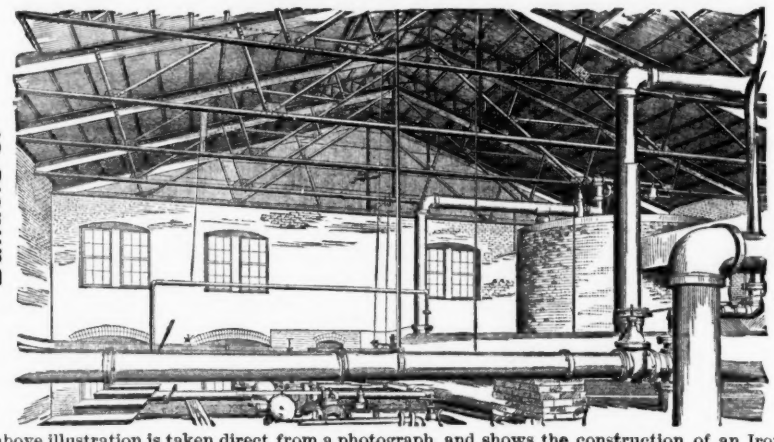

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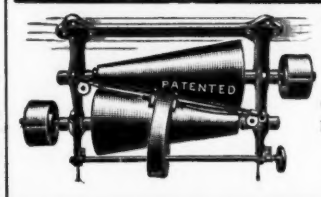

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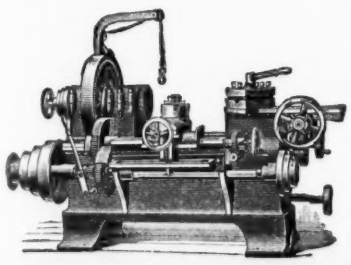

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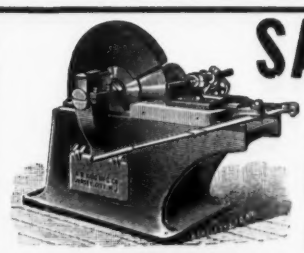

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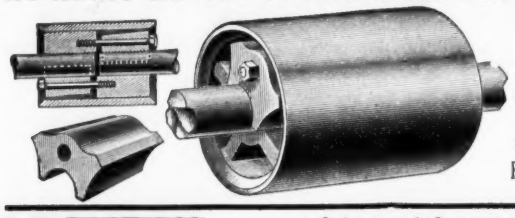

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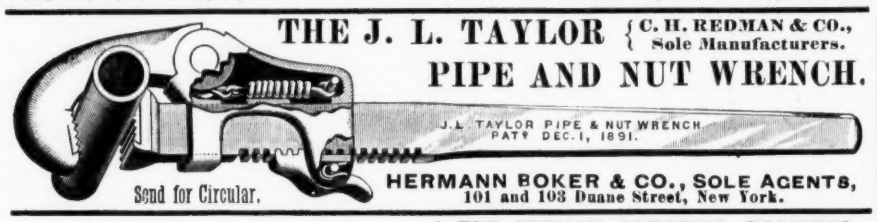

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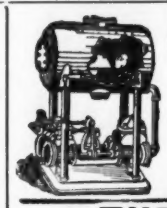

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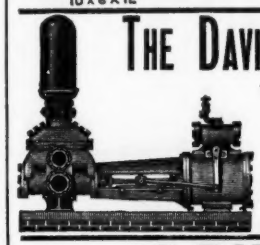

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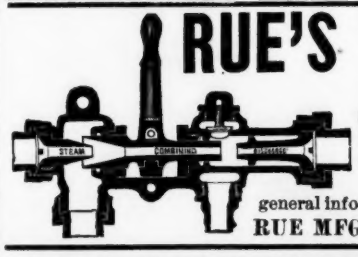

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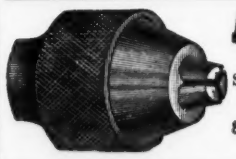

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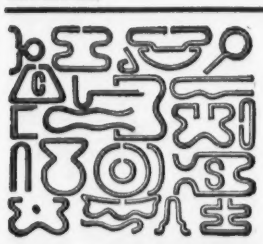

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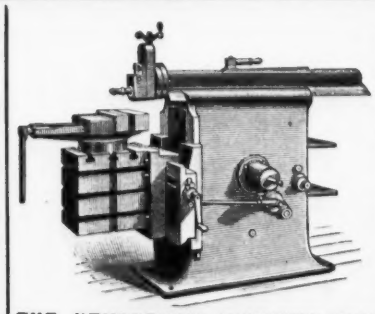

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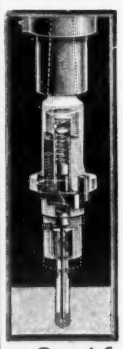

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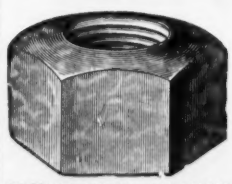

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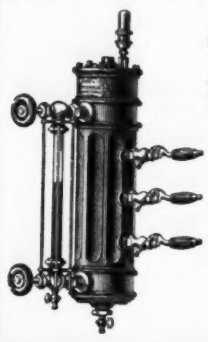

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3	6 "	0 to 1½ inch.
4	6¼ "	0 to 2 "
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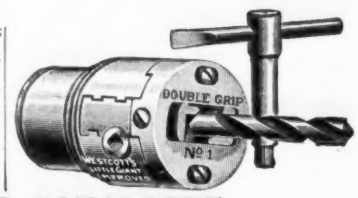

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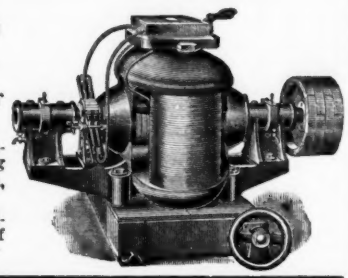

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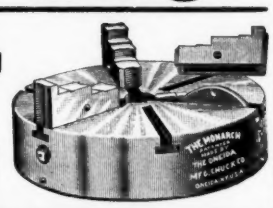

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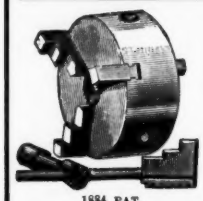

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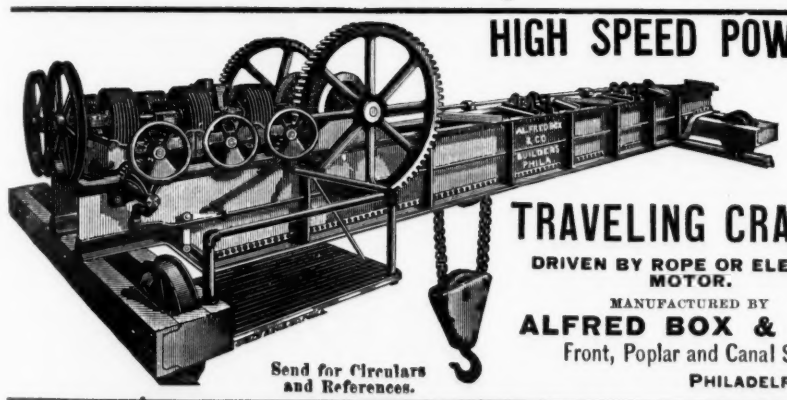

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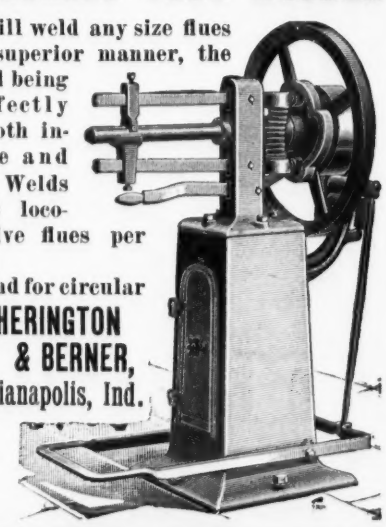

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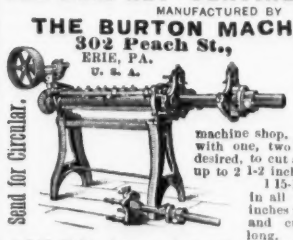

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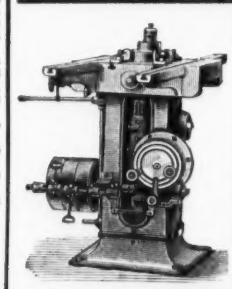

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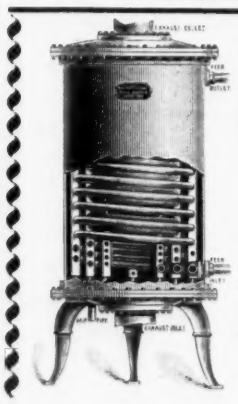

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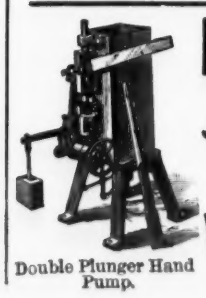

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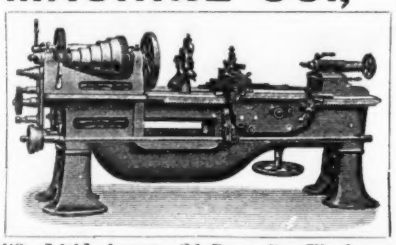

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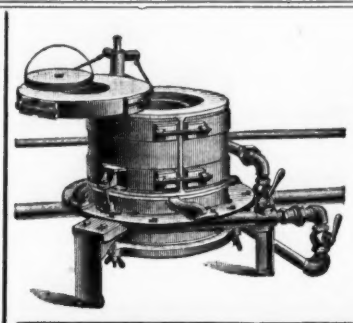

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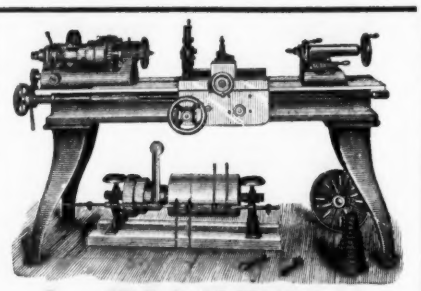

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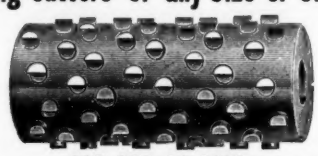

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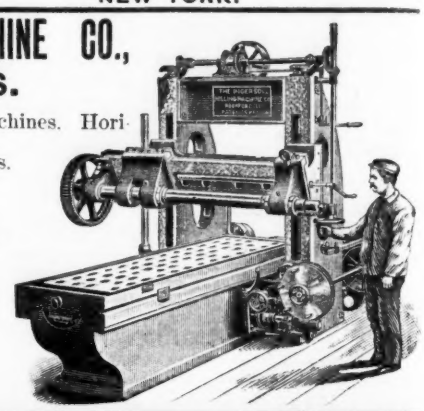

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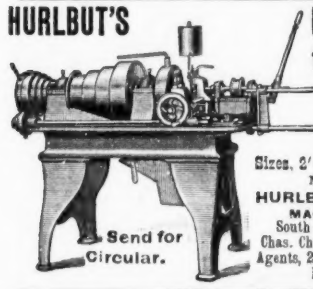

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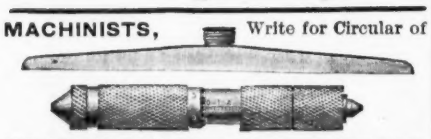

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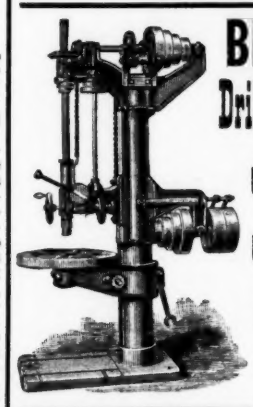

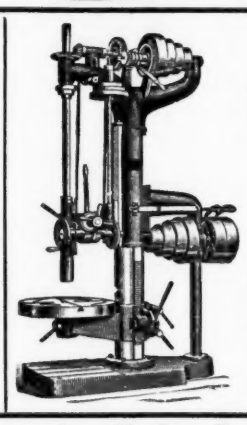

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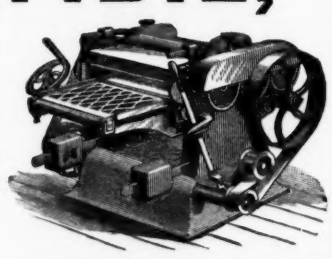

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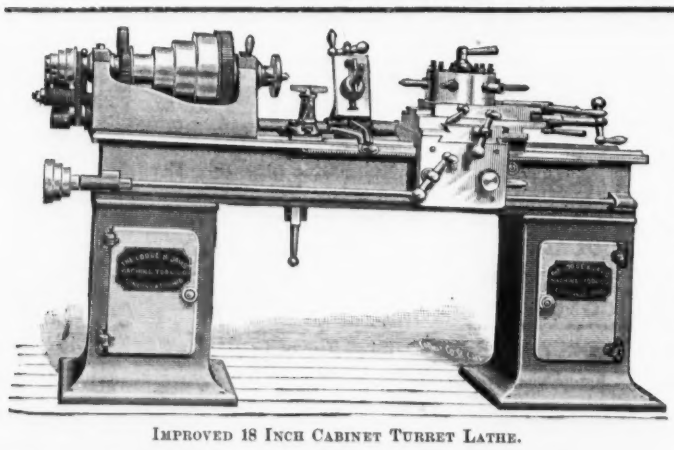

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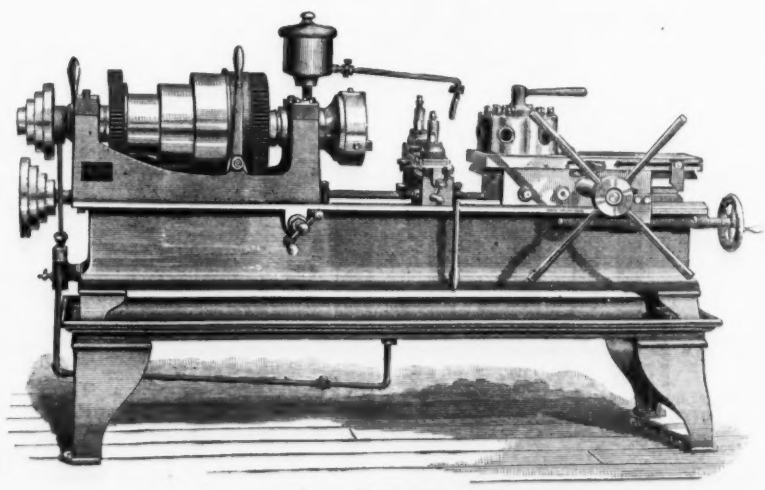

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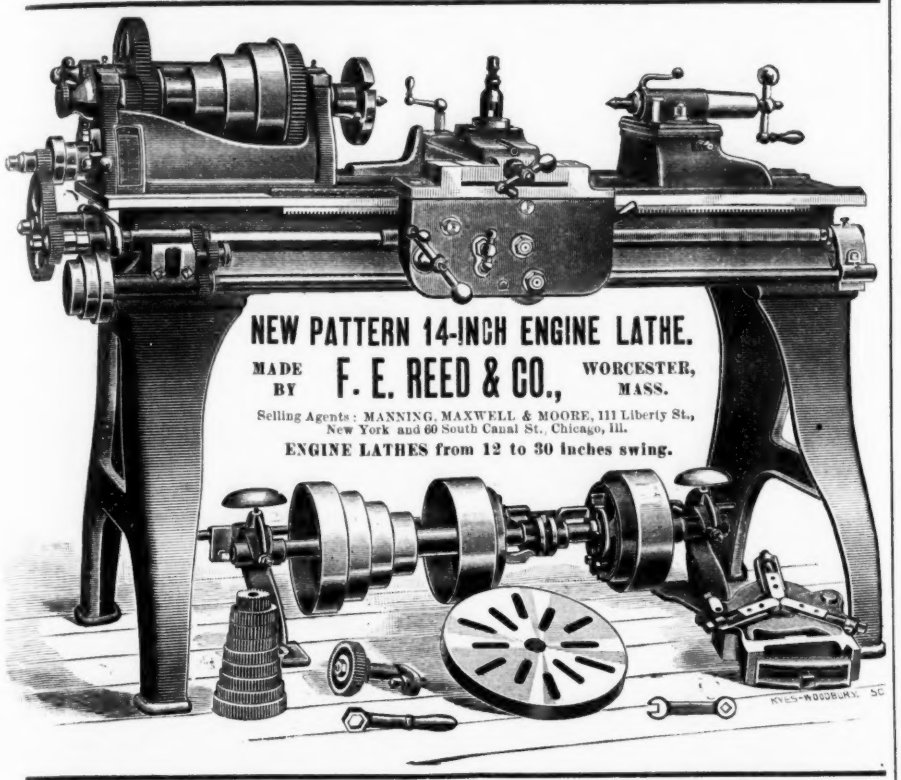

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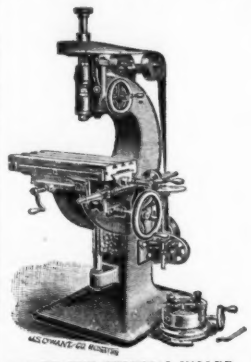

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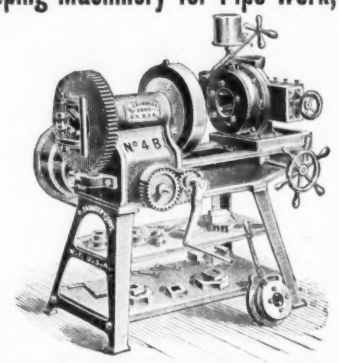

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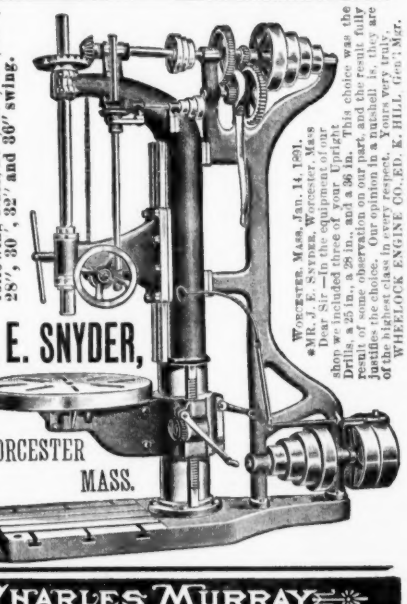

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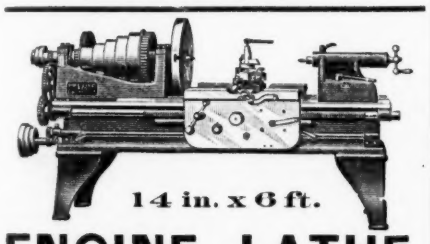

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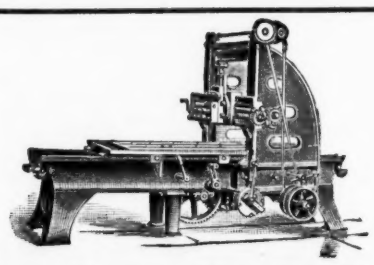

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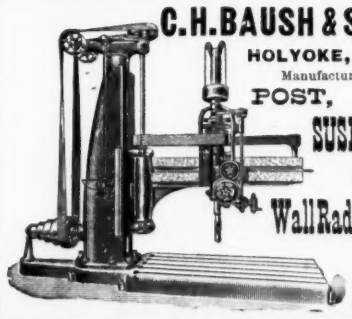

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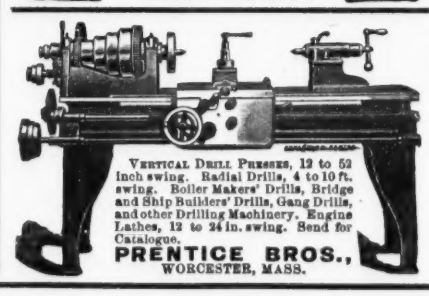

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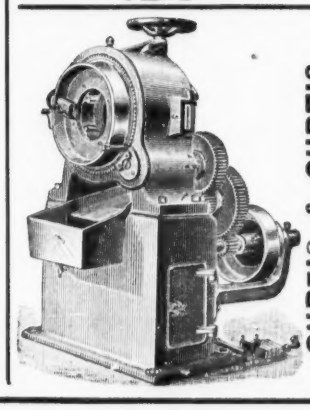

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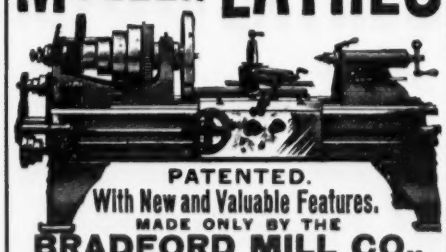

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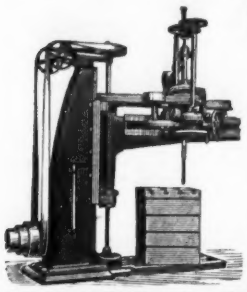

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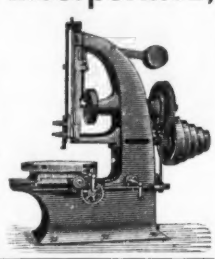

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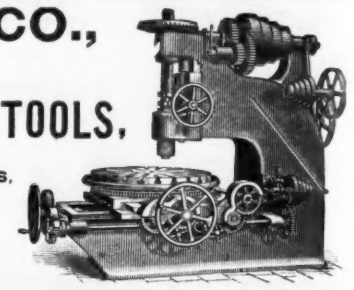

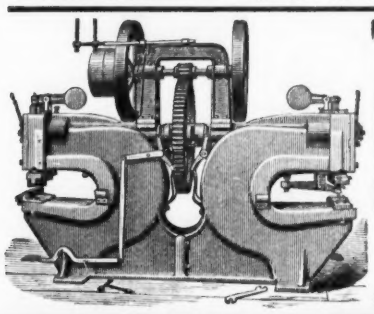

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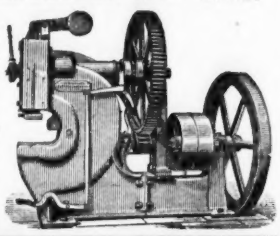

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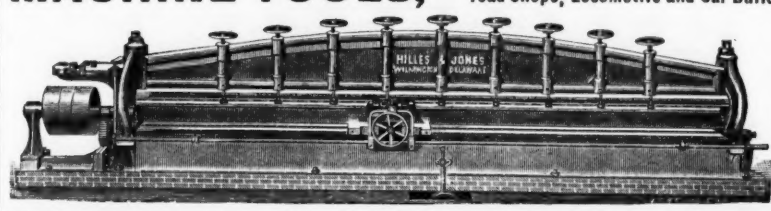

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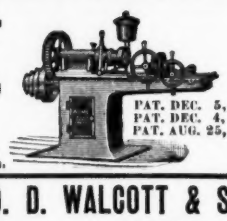

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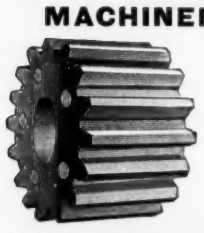

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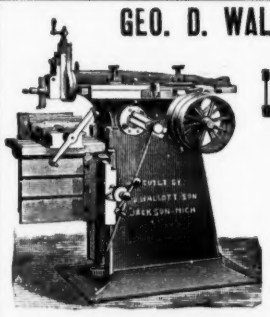

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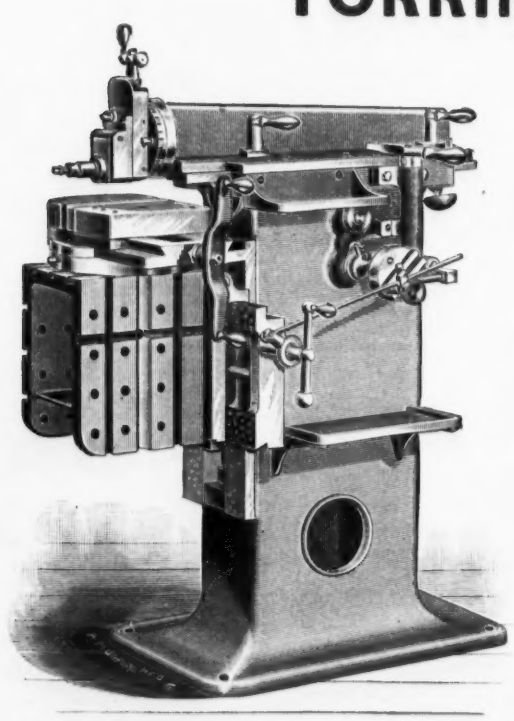

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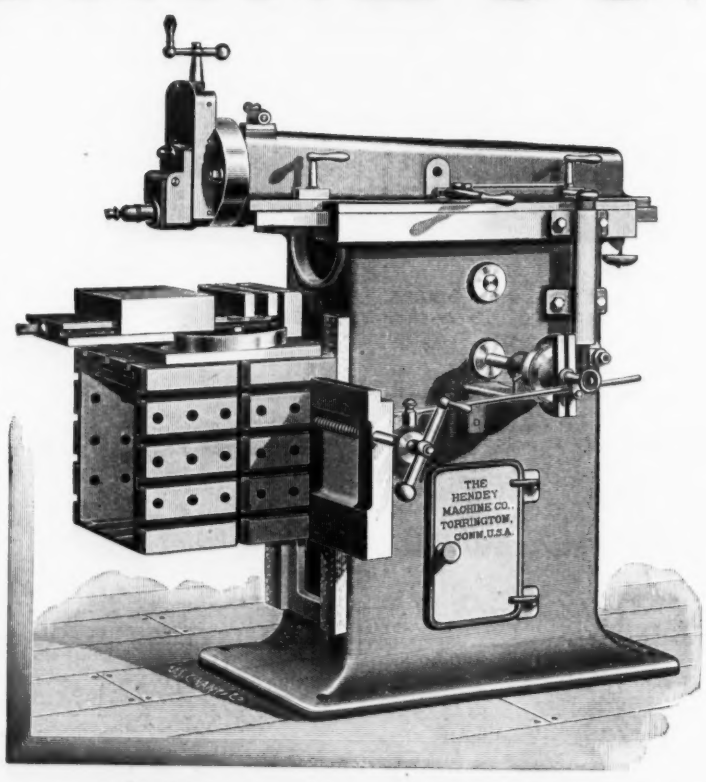

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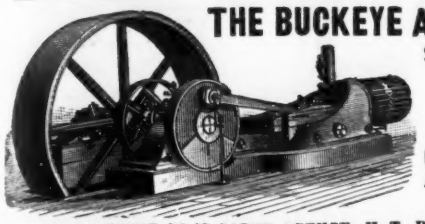

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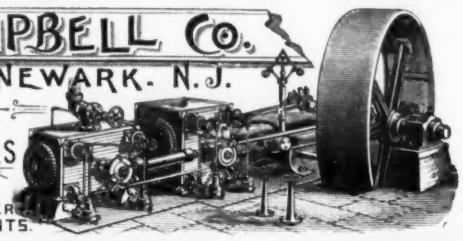

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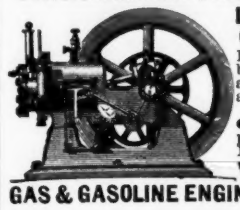

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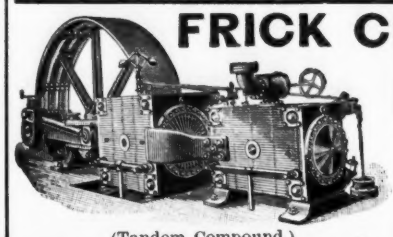

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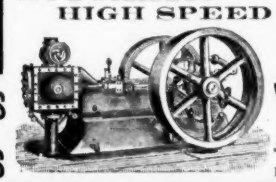

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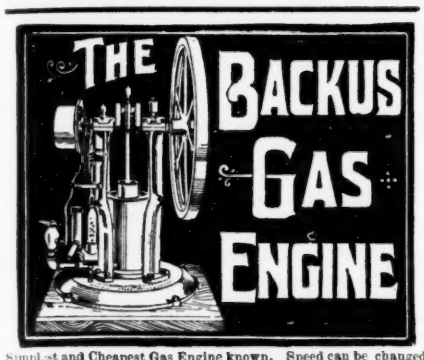

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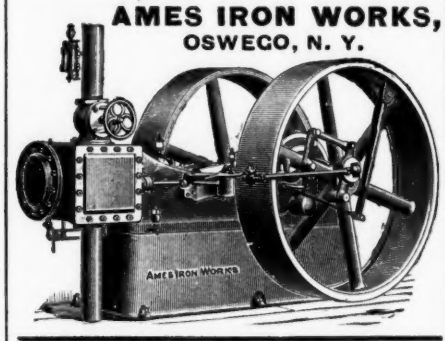

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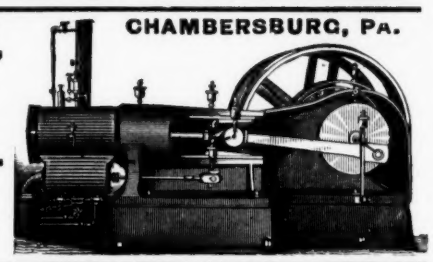

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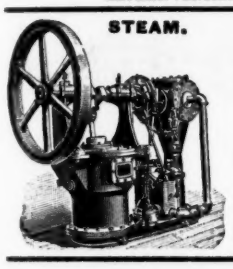
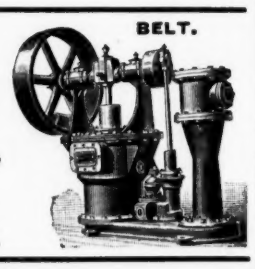


BELT.



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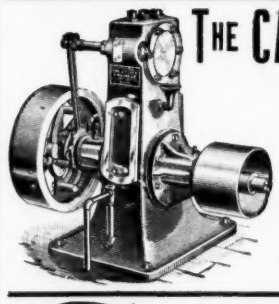

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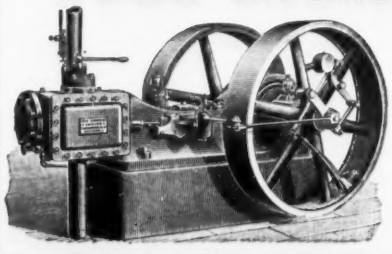

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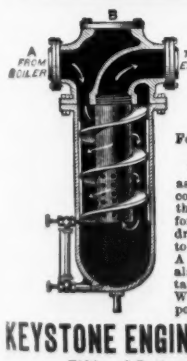

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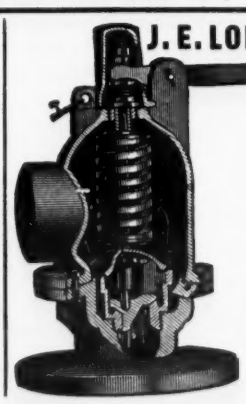

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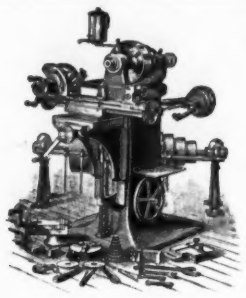

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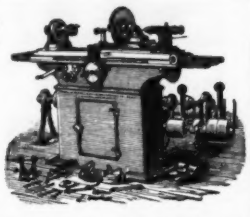

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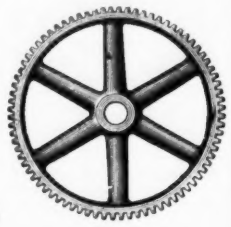

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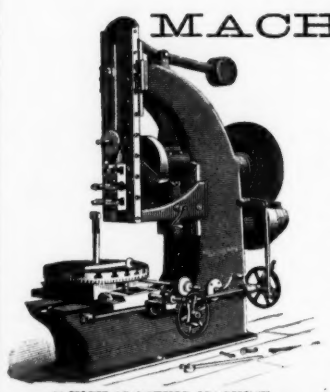

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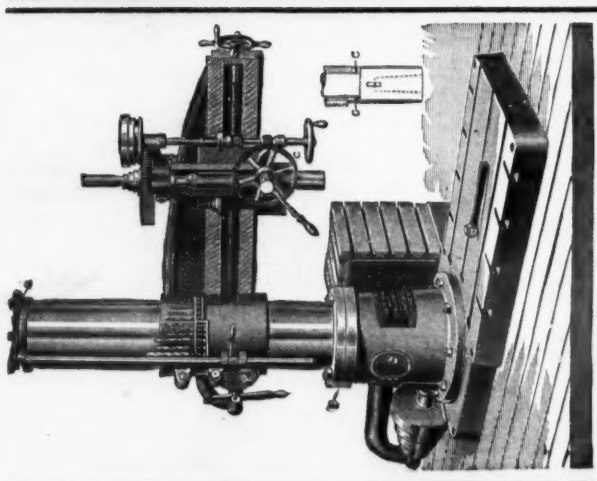

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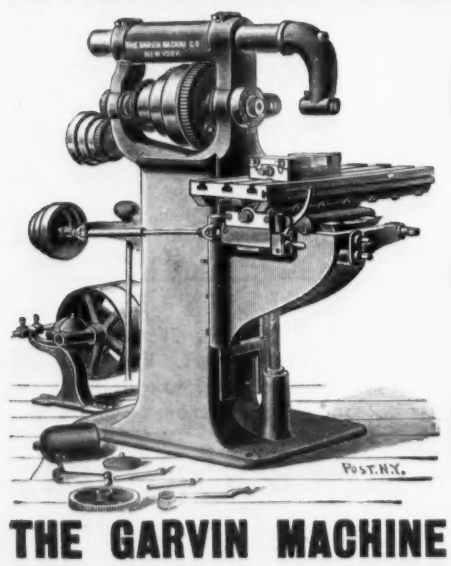

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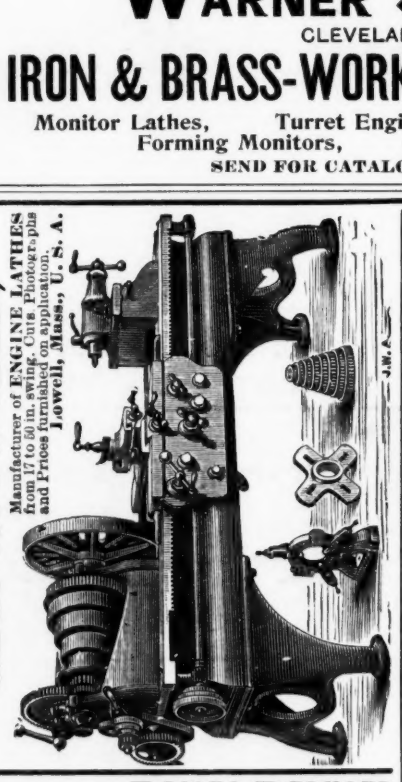

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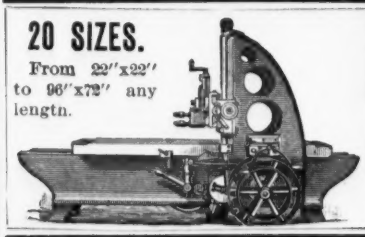

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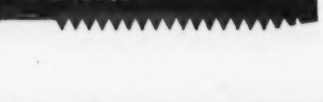

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